# HOW TO IMPROVE IMAGE QUALITY IN 3D VIEWING

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These comments apply to all types of displays, but especially to CRT's (tube type TV's and monitors), DLP TV's and projectors and to the new LED Backlit LCD 3DTV's and Plasma TV's appearing in 2010, especially when operated at 50 or 60hz with field sequential 3D input from standard definition DVD's or PC's or with a downconverter from 3D BluRay or broadcast.

## l. FLICKER REDUCTION ON THE DISPLAY SCREEN

l.  WITH THE PROGRAM RUNNING, PUT THE GLASSES ON AND REDUCE THE ROOM LIGHTING AND ADJUST THE TV BRIGHTNESS AND CONTRAST TO GET THE BEST PICTURE WITH LOWEST FLICKER.  Especially troublesome are any lights behind or to the side of viewers as these reflect off the inside of the lenses into the eyes.

2.  IF POSSIBLE, USE LCD SHUTTER GLASSES WITH SIDE AND TOP SHIELDING AND WITH MEDIUM (NTSC) OR 60HZ DARK (50HZ PAL, SECAM) PLASTIC FILTERS IN THE LENSES. WITH SOME MODELS THE FILTERS CAN BE EASILY CHANGED. SEE INSTRUCTIONS FOR 3DTV CORP MODEL C WIRED GLASSES.

3. If you are making your own images, you can markedly reduce the flicker avoiding high luminosity areas in the image(i.e., white walls, bright yellow clothes, bright blue sky etc. This is not as hard as it seems and many films and videogames are nearly perfect already.  With room lights low and tv brightness down, there is almost no flicker in many programs.

4. DECREASE THE  BRIGHTNESS OF THE  HIGH BRIGHTNESS AREAS OF THE  IMAGE.

This is NOT the same as turning down the brightness or contrast of the display! There are some expensive pieces of video eqpt. such as the DaVinci which have a "white gamma control" which turns down only the brightness of the whites and some PC video cards have such controls. With a pc or any device with sufficient processing power, such as XBOX, PS3, or recent DVD Players, TV's, Set Top Boxes etc, you can write a program which will do this realtime.

**5. CLOSELY MATCH THE BRIGHTNESS OF THE  RIGHT AND LEFT IMAGE.**

Diner has shown that there is a marked reduction of flicker in video images when the camera luminosities are carefully matched with a photometer. They do NOT come this way from the factory! If you already have the images you can match them with a program on a pc etc. Of course image matching presumably will not be a problem with videogames or with 2D to 3D conversion.

THE FOLLOWING EXPERIMENTAL METHODS WILL ELIMINATE ROOM FLICKER ONLY (i.e., the images will still be updated at the display frame rate).

l. Rolling chop—i.e., interrupting the image of each eye at a different horizontal level during each field, moving to bottom of the frame and then back to the top.  I thought of this many years ago but never implemented it.
2. Put a polarizing sheet on the tv set or crt projector and remove the front polarizer from the LCD shutter glasses.  I thought of this long ago and so did several others who patented it so it's now public domain.  Its also been accomplished by putting the shutter on the display and having the user wear passive polarized glasses (StereoGraphics/ColorLink Z screen, which evolved into the RealD XL Cinema system, and also by Tektronics/NuVision/McNaughton and Idemitsu).
3. Masking down the LCD glasses aperture to block the light from the room. Can be done with physical means or electronically.
4. Switching the glasses at line rate (i.e., every line- which requires special shuttering tech and may emit high frequency EMF without special shielding).

## 2. FINGERPRINTS

Maybe 80% of the time when people view stereo images with glasses of any kind, they are looking through their own fingerprints which blur the image and diminish the stereo.  It is critical to repeatedly and prominently warn them to wipe the fingerprints off the inside and outside of lenses with a tissue EVERY time they put on the glasses!  If you check this yourself you may find that you nearly always have prints on your own 3d glasses.

## 3. IMAGE QUALITY

Maybe 95% of the time when people view stereo at home, the image quality is not optimal due to poor adjustment of color, sharpness, brightness and contrast. Again, it is critical that they be repeatedly advised to adjust these parameters with the glasses on and the program playing. If viewing SpaceSpex images(our custom

orange/blue anaglyph paper glasses method) or other anaglyph method, this is even more important.

## 4. GHOSTING

l. Ghosting or crosstalk (bleeding of right eye image into left eye and vv) is a major cause of poor image quality with all glasses techniques. One of the best ways to minimize it is to keep horizontal parallaxes (displacement of the right and left eye images)  to a minimum. Since low parallax also reduces eyestrain, this is a cardinal rule of stereo. The sure sign of an amateur (and one present in nearly all commercial stereo until quite recently) is continual use of large parallax.  **Games and some TV's let the user adjust this (it's called "depth", "3D Effect", etc).**

2. There will always be some ghosting due to imperfect cancellation due to polarizers and depolarization by LCD and to image persistence .  Some TV's and monitors and projectors will not give a good 3D image with shutter glasses or polarizers, even if they are very expensive. DLP projectors and TV's or the new OLED's or laser projectors have no inherent ghosting and should give a superior image.

3. USE A GHOST REDUCTION ALGORITHM. One of the reasons the Neotek and TriD (pc software available for free download on the 3DTV Corp page) images look good is that John Urbanic spent alot of time writing a ghost reduction algorithm. There has been a lot of work on this and I cite various patents in my articles.

## 5. DISPLAY ADJUSTMENT

l.   It is CRITICAL that you eliminate ALL glare from the monitor or TV screen by reducing room lights and/or turning the screen away from windows etc.
2. If you have a tube type monitor or TV (CRT), it needs to be degaussed periodically to keep the image sharp (usually a button or key for this).
3. Resolution/Brightness/Color/Contrast of your monitor/video card , TV, or projector may be significantly better at certain resolutions than others.
4. Video card controls:  Most PC cards and some other displays permit adjustment of the color temperature/gamma etc. and these should be optimized for stereo.
 5. No type of LCD monitor, laptop, projector or TV will work with shutter glasses except several small monitors introduced for the Nvidia 3D Vision system in 2009 and the new large 3DTV sets introduced in 2010.  There is no way to view 3D on older LCD's except with anaglyph glasses and the best of these are the 3DTV Corp SpaceSpex and the ColorCode glasses (both yellow/blue gel filters).