3D & Visual Technology

Knowledge & Experience is Sovereign

Production of high-quality 3D content requires skills, knowledge, and experience, and there are remarkably few quality tools and skilled consultants available to help. The result, unfortunately, is that many of the 3D images, movies and animations you find on the market are difficult or unpleasant to view.

SBS 3D LAB is all about 3D and Visual Technology with more than 30 years of scientific and practical experience in the field. Moreover, we do R&D and provide services regarding A3D, A3D 60, A3D 45 and the RVE image-enhancement process.

Production of high-quality 3D

There are various technical reasons why 3D is so hard to get right. You can find some of the basic problems and solutions described below.

Never use too large depth effect

Just because you can see a 3D image comfortably does not mean everyone else can. The more you personally use 3D the more adapted you become to the effect. If you are producing content for novice audiences (particularly children) be conservative with the amount of depth effect (parallax difference) you use. It may be dramatic to use lots of depth but you will run a great risk of people remembering the eyestrain or headache they felt instead of the message in the content. In short, there is a high risk that you will cause people physical pain!

The maximum parallax difference (depth budget) for a display / screen width in the range from iPad to IMAX (240 mm to 24000 mm) has to be approx. 3% of the image width in general. This limit can be exceeded for specific editorial needs in movies, such as a few seconds of visual impact if managed appropriately and in line with 3D production practice and with a maximum depth budget of 4,5%. This to ensure the 3D material is easy and pleasant to view for an average spectator.

Never use converged camera axes

It is a common misconception that 3D cameras should use converged camera axes (toed-in camera axes).

The 3D camera is not a substitute for your eyes. It is a tool, which produces an imitation of the original scene toward which your eyes function just as they would do with the real scene. The converged camera axes model results in keystone distortion that introduces incorrect sizes of and distances between objects in the scene plus vertical offset between corresponding points in the Left and Right image. This means that you will never be able to look into the distance of the scene without severe discomfort. Finally, there is a risk of "depth plane curvature" - flat planes can appear bowed in the centre toward the camera. However, the keystone distortion can be corrected by some post-production software.

Since the camera axes converge on the area of interest the result is often that everything in the foreground and the background of the scene will go out of focus and get blurry. This is not acceptable because 3D is supposed to be sharp all over to let the spectator explore the scene just as in real life.

Always use a 3D camera setup with parallel camera axes. Simply because that will produce uniform and satisfying 3D images and movies under all conditions and with all types of scenes. Finally, it will allow our eyes to converge normally.

Do not violate the Stereo Window

The Stereo Window, which is the display screen frame or the edges of an image, must never cut off or touch an object in viewer space.

If the frame or the edges of an image cuts off or touches an object in viewer space, there will be a conflict between two depth cues. One cue, interposition, tells you that the object must be behind the window since the frame cuts it off. The other cue, negative parallax, tells you that the object is in front of the window. Because this anomaly never occurs in the real world it will cause severe viewing problems.

Objects in a scene can also be moved too far into the space behind the Stereo Window. If you exceed 65 mm between the corresponding far points when you scale up a 3D image e.g. by projection it will cause severe viewing problems too.

When using existing 3D material you will realise that a lot of this material does not comply with the rules for correct implementation of the Stereo Window. This is due to the fact that many 3D professionals, unfortunately, have very little or no knowledge about how 3D material interacts with the human eye-brain system.

The best working compromise is normally to set the Stereo Window to what I call MesoStereo™. This means that most of the scene is behind of the Stereo Window, but still with some of the scene in front of the Stereo Window.

You should only use MesoStereo when it is possible to do so without violating the Stereo Window. In cases where this is not possible it is recommended to combine MesoStereo with a Virtual Window to solve the problem.

The Virtual Window (hovering window) is used to force the Stereo Window to hover in front of the screen or print, ensuring that the objects in the 3D image are kept behind the Stereo Window. Thereby the objects can come out of the screen without the need for a complicated composition of the scene to prevent objects from being cut off by the edges of the screen.

This means that objects can still stand on the ground, even when they are in front of the screen, and they can do so without violating the Stereo Window. The Stereo Window detached from the screen by the Virtual Window is a phantom object and will not be caught by the eyes, but allows the eyes to slide freely forth and back in the image and thereby increase the realism of the scene.

Create balance between the Left and Right image

The exposure and color balance between the Left and Right image are rarely perfect straight from the camera. It is therefore important to correct exposure and color mismatches to create balance between the Left and Right image and thereby ensure a comfortable 3D experience.

Do not record images with very high contrast

Avoid very high contrast and the use of white objects on a black background and vice versa because it will cause “ghosting” problems with 3D systems using glasses. Finally, lines or flat surfaces can also cause “ghosting”.

Make the images as bright as possible

All 3D systems using glasses are causing light loss. The average light loss is approx. 70%, and it is necessary to compensate for this light loss. Displays: Increase the brightness of the backlight. Projectors: Use a projector with at least twice the light output you would choose for a 2D projection on a screen of similar size.

Ten basic 3D rules

1. Think 3-Dimensional when you compose or choose your scene • The scene should always contain foreground, middle-ground and background if possible.
2. The camera axes must always be parallel to avoid geometric distortion.
3. Never exaggerate your camera base (interaxial distance) • Use a 3D Calculator.
4. The near point distance has to be chosen very accurately.
5. The Left and Right image in a stereo pair must always be congruent in all aspects apart from horizontal parallax.
6. Never record stereo pairs with very high contrast.
7. Keep everything sharp in a stereo pair • The only exception is distant backgrounds.
8. Never violate the Stereo Window • The display screen frame must never cut off or touch an object in viewer space.
9. Never exceed 65 mm between the corresponding far points when you scale up a 3D image e.g. by projection • Adjust accordingly.
10. Always show 3D images and movies with a viewing distance of 1.5 to 2x the display width in a room with subdued ambient light.

Svend B Sorensen
SBS 3D LAB
Denmark
E sbs.3d@me.com
W sbs3dlab.eu

