GLOSSARY OF TERMS USED IN 3D POST PRODUCTION

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There is some ambiguity in the use of terms that describe processes used in the post production stage of creating 3D content. This document lists terms employed at In-Three and how we use them to communicate among ourselves and with prospects and clients:

Depth Matching: Depth Matching means adjusting shot to shot parallax (Stereo Distance) so that the viewer's eyes are not forced to change convergence too rapidly. To Depth Match, the stereographer matches the Stereo Distance of objects of dramatic interest in successive shots. Depth Matching eliminates the Dash Board Effect.

Ramping is one technique for Depth Matching. Another is Registering a whole shot's depth so the objects of dramatic interest in adjacent shots are near the same Stereo Distance. A third is Depth Grading the objects that need depth adjustment.

Convergence and Focus: These two terms are important to understanding how 3D works. Convergence describes the angle of the eyes' axes of vision. For example, at infinity, the eyes' axes of vision are parallel and about 2.5 inches apart (i.e., the average adult "interpupillary distance").

Focus, on the other hand describes how the eyes are shaped so as to project a sharp image onto the retina.

Separate sets of focusing and converging muscles send depth cues to the brain. Therefore in viewing 3D one faces a Fundamental Disparity. It involves the fact that the eyes are always focused on the screen, but they converge wherever parallax causes them to track. For most people it is convergence that determines the depth perceived not focus. However, a small percent of the population is sensitive to these conflicting depth cues.

Dash Board Effect: The Dash Board Effect describes the difficulty of reconverging one's eyes as Stereo Distance changes rapidly. You can experience this difficult transition while driving by looking back and forth from your dashboard to the horizon. It takes time for the eye's focus and convergence to settle in. Similarly, shot cuts that cause rapid reconvergence are difficult for an audience to watch.

Depth Grading: By Depth Grading we mean changing the internal depth of a scene by changing the depth, shape and perspective of an object or group of objects to achieve an artistic goal. For example, we might change the Stereo Distance of an object of dramatic interest so that the viewer's eyes are left converged at the same distance to the screen at which objects in the next shot appear. This makes shot-to-shot transition comfortable for the audience. (Depth Grading is important to us at In-Three because by focusing depth changes on specific objects, we prevent overall depth from becoming extreme.)

Another use of Depth Grading is to create "surreal depth". For example for people viewing the sky, clouds are so distant that there are no convergence or focus depth cues. With Depth Grading a stereographer can create a puffiness not experienced in nature.

Floating Window: In this discussion keep in mind that when an object in the right eye's view is to the left of the same object in the left eye's view – negative parallax -- the eyes track the objects independently and cross in front of the screen. This creates the perception that the object is closer to the viewer than the screen distance. When the object's views are separated by positive parallax -- that is the right eye's view is to the right of where it would appear on a screen and the left eye's view is to the left -- the eyes converge behind the screen.

With this in mind think of what happens in the four following situations:

If an object with negative parallax passes off to the left, partially occluded by the screen's left border, then the right eye will see less of the object that the left eye.
If the object passes off to the right, partially occluded by the screen's right border, then the left eye will see less of the object that the right eye.

In each case the viewer will experience a visual disparity. He will either sense or actually perceive a problem and, over time, will be "pulled out of the story" trying to understand the anomaly. This situation can be corrected by cropping the left-eye or right-eye frame so that both eyes see the same width of the object. This causes the cropped content to appear to float off the screen; it is called a "floating window" or "virtual window".

Now consider positive parallax. If an object with positive parallax passes off to the left, partially occluded by the screen's left border, then the left eye will see less of the object that the right. If the object passes off to the right then the right eye will see less of the object. However, this kind of occlusion we experience whenever we look out a window or through a door. Therefore, the 3D shot will look normal to us and no corrective action is required.

Fundamental Disparity: See the section on Convergence and Focus for a description of Fundamental Disparity. The Fundamental Disparity is not a problem for most viewers in a theater. It becomes a problem when viewers sit close to a screen, that is, when watching 3D on a television. Depth Grading can adjust Stereo Distance so that 3D on television retains its impact and yet is comfortable.

IPD: Interpupillary Distance is the distance between the viewer's eyes. Generally "inter-ocular" is used to describe the distance between the centers of real or virtual (i.e., CG) dual camera lenses.

Adult's IPDs average 2.5 inches. Children's' average 2.0 inches and create 25% more parallax than adults experience. 3D content providers should take this into account when preparing family fare.

Perfect 3D: We use the term Perfect 3D to describe executing a director's vision in 3D with no distracting disparities in the content.

Ramping: Ramping is any technique that changes an object's or shot's Stereo Distance gradually so that the viewer's convergence is left where the next shot picks it up. Ramping can be used to eliminate the Dashboard Effect.

Registration: Registration is the moving of the left eye view in a stereo pair with respect to the right eye view. If the right eye view as it appears on a screen is moved to the right, all parallax values are increased and the Stereo Distance of the whole scene increases – that is the scene moves away from the viewer. Movement left of the right eye view decreases the Stereo Distance of the whole scene.

Registration can be used for Ramping. However excessive registration can cause extreme 3D in the foreground or background. For example, background parallax or Stereo Distance may be "pushed" beyond infinity or 2.5 inches on the screen causing a viewer's eyes to diverge.

Stereo Distance: We measure the perceived distance from the viewer to 3D object as a percent of the distance to the screen. For example if we have Depth Graded an object to appear half way from the viewer to the screen the Stereo Distance is 50%. (In this case the parallax is -2.5 inches, and the eyes converge at the same point they would have if the real object had been placed at that precise point in space.)

If there is no parallax between what the right and left eyes see, the object appears at screen level and the Stereo Distance is 100%.

If there is positive 1.5 inches of parallax in the two eyes' views, the object appears at a Stereo Distance of 250%, i.e., it appears at one and one half times screen distance beyond the screen.

With parallax of 2.5 inches objects appear at a Stereo Distance of infinity.

Virtual Window: See Floating Window