CAS in Teaching Basics of Stereoscopy

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We use Wolfram Mathematica in teaching the basics of stereoscopy. Each stereo image is represented either as a stereopair (for parallel and cross-eye views) or as an anaglyph image (to be viewed with red-cyan glasses). By changing the parallax of the left and right parts of the stereogram, one can move the image (or some part of it) in front of or behind the window frame. We demonstrate basic stereoscopic effects and typical mistakes made by beginners.

Soon after the invention of photography in 1839, a first suggestion for a stereo camera was given by Brewster in 1847. By 1860 viewing stereo photos was a popular pastime [1]. Later - in 20th century - interest waned. Recently, with the development of technology interest in 3D imaging has increased: 3D cameras are available; 3D lenses exist for cameras and smartphones; 3D cartoons and movies can be watched on an ordinary tv or computer screen using anaglyph (red-cyan) glasses; there are special 3D TVs, 3D movie cinemas, glasses-free 3D displays, etc.; and, finally, the recent development of virtual reality.

Here, we demonstrate some basic tricks one can do with changing the position of the stereo window and basic mistakes of beginners (and not only beginners - similar mistakes can be seen in big-screen, multi-million-dollar budget movies!). For example, one of the standard "Wow!" effects with 3D images is when most of the image appears behind the frame, but part of the image is hanging out in front. One has to be careful: that part shouldn't be cut by the frame! It is especially important in action scenes when objects which are moving around can easily be cut by the frame border.

Wolfram Mathematica provides good tools for image processing as well as powerful analytic tools, 3D graphics and animation. These allow one to easily construct simple stereograms; demonstrate effects and distortions introduced by the incorrect methods of constructing stereo image; and manipulate constructed images to demonstrate different effects. We use Mathematica to demonstrate correct and incorrect "Wow!" effect realizations of the type described above. By changing relative parallax of left and right images, we change position of the image with respect to the frame. Our manipulations with stereo images we base on a classic textbook by J.G. Ferwerda [1].

Keywords: Stereoscopy, 3D Imaging

References

[1] J.G. FERWERDA, *The World Of 3-D: A Practical Guide To Stereo Photography* . 3-D Production, 2003.

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