

The New Realm of 3-D Vision

People seeking 3-D special effects are usually forced to wear plastic shutter glasses. Now consumers can put those retro glasses away and still enjoy 3-D effects using their own home computers. Dimension Technologies Inc. (DTI), of Rochester, New York, developed a line of 2-D/3-D Liquid Crystal Display (LCD) screens, including a 15-inch model priced at consumer levels. DTI's family of flat panel LCD displays, called the Virtual Window,[™] provide real-time 3-D images without the use of glasses, head trackers, helmets, or other viewing aids.

Most of the company's initial 3-D display research was funded through NASA's **Small Business Innovation Research (SBIR)** program. NASA sought a way to enhance its understanding of great masses of data, like those for fluid flow around Space Shuttle launches. Believing that a 3-D presentation of this information would aid in its interpretation, NASA's Ames Research Center awarded DTI several SBIR contracts to develop its 3-D technology. As a result, the company succeeded in providing

specialty displays for NASA, in addition to developing a commercial product.

The images on DTI's displays appear to leap off the screen and hang in space. The display, which also comes in an 18.1-inch model, accepts input from computers or stereo video sources, and can be switched from 3-D to full-resolution 2-D viewing with the push of a button. The DTI displays are the only ones in the world with the ability to convert instantly from 3-D to 2-D. With the product's eyeQ[™] technology, users can position themselves correctly for the maximum 3-D effect. EyeQ works by placing a small red LED (light emitting diode) on the front panel. If the red is visible, the users reposition their heads until the LED appears dark. The cue is mostly used by new users of the display, much like training wheels on a bike. Experienced users position themselves automatically.

The DTI display achieves the 3-D effect by simulating the most powerful visual cue that the human visual system uses to construct internal three-dimensional models of what it is



The Virtual Window[™] system tricks the brain into seeing 3-D by creating two images of an object as seen from two slightly different angles. The image appears to leap off the screen as a result.

Image courtesy of Dimension Technologies Inc., www.dti3d.com

seeing. This cue, called binocular disparity, gives viewers the vivid sensation of depth that is only seen when looking at the real world or a 3-D movie. Binocular disparity is the slight difference between what the left eye sees and what the right eye sees. Because left and right eyes look at the world from two slightly different locations, about 2.5 inches apart on average, the shape of an object seen by each eye is slightly dissimilar, as is the way the two images of the object line up with one another. A person experiences this disparity by looking at an object with only one eye and then the other. The brain processes the differences in these two views to provide an accurate representation of the three-dimensional shape and position of the object, resulting in the real depth 3-D humans see in the real world.

The DTI system fools the brain into seeing real depth by creating two images of a scene as seen from two slightly different viewing angles. It then takes one image and displays it on the odd pixel columns of a LCD screen, while placing the other image on the even columns. Thin light sources behind the screen send light through the odd and even columns, which travels out at slightly different angles toward the viewer. Since the different light sources only reach the corresponding left or right eye, each eye only sees one of the images. The brain blends the two images into one, creating an image that appears to float in space in front of the flat panel screen. Adding real depth information to any presentation makes the information easier and faster to understand.

The Virtual Window displays have applications in data visualization, medicine, architecture, business, real estate, entertainment, and dozens of other research, design, military, and consumer applications. Displays are currently used for computer games, protein analysis, and surgical imaging, to name just a few. Hundreds of worldwide users include NASA, Goodyear,



DTI's flat panel LCD displays provide 3-D images without any special viewing aids.

Image courtesy of
Dimension Technologies
Inc., www.dti3d.com

Microsoft,[®] Northrop Grumman, Honeywell, Lockheed Martin, Kodak, all branches of the military, Massachusetts Institute of Technology (MIT), Stanford, Johns Hopkins, and about 40 other worldwide educational institutions. The technology greatly benefits the medical field, as surgical simulators, which allow virtually unlimited practice with open surgical techniques, are helping to increase the skills of surgical residents. DTI believes that the screens will gain increased use as new software, more powerful desktop PCs, and increased production quantities drive down costs. DTI is actively seeking licensing partners to incorporate the unique 3-D technology into their flat panel displays, thereby increasing production and decreasing costs. 3-D technology in everyday use may be closer than it looks! ❖

Virtual Window[™] is a trademark of Dimension Technologies Inc.

Microsoft[®] is a registered trademark of Microsoft Corporation.