Economist.com SCIENCE TECHNOLOGY QUARTERLY

3-D imaging

3-D: It's nearly there

Sep 3rd 2009
From The Economist print edition

Three-dimensional imaging: New technologies that display 3-D visuals are on the verge of spreading from cinemas into the wider world

Sara Forrest

BRIGHT and crisp high-definition (HD) images, a luxury not so long ago, are fast becoming standard in consumer electronics. HD technology is now well entrenched in the marketplace in the form of televisions, video cameras, Blu-ray players, games consoles and projectors. There seems little scope to improve the display of two-dimensional images, which provide about as much detail as the human eye can appreciate. So attention is shifting to the next frontier in display technology: three-dimensional (3-D) images.

In recent years 3-D cinema projection has made a dramatic comeback, shaking off its image as a gimmick and replacing the cheesy old red-and-blue glasses with new technologies that are easier to use and produce more lifelike results. Studios love 3-D because it is immune to piracy. Cinemas love 3-D because it allows them to offer something that even the most elaborate home cinema cannot match, and charge more for it. Now 3-D seems to be on the verge of moving out of the cinema and into a wider range of products.

Would you look at that

Better and cheaper 3-D display technologies for home and office use are “ready for prime time”, says a senior executive at Wistron, a Taiwanese firm that manufactures computers for many leading brands. By the end of this year the first mass-market laptops capable of displaying 3-D images will be on sale, he says, and by the end of 2010 all of the world’s top ten computer-makers will include 3-D displays in their product line-ups. At the Consumer Electronics Show held in Las Vegas in January, prototype 3-D televisions and other products were unveiled by JVC, LG, Panasonic, Samsung, Sony and others.

Such prototypes have been around for a few years, but they have recently made rapid progress, and the industry is now stumbling towards agreeing on the necessary standards. Even without such standards, several firms plan to launch 3-D products and services next year anyway. Beyond that, even more elaborate technologies are under development that use holograms to display 3-D images.

Creating images that appear to burst forth from a screen and invite you to reach out and touch them is not easy. One way of doing so is to use “stereoscopic” optical technologies, in which scenes are filmed from two angles. When displayed, special eyewear then ensures that one perspective is beamed exclusively to the right eye and the other to the left eye, fooling the brain into thinking that it is looking at a 3-D scene. So-called “autostereoscopic” 3-D systems do not require glasses. One approach uses tiny lenses on the front of the display to direct images for the left and right eyes in several different directions. Provided your head is in the right place, and you keep it still, a 3-D image appears.

But building a 3-D display is only one piece of the puzzle: there must also be 3-D content to show on it. A games console can be programmed to produce separate images for left and right eyes relatively easily, but most films and television programmes are not shot in 3-D. Now, however, it is possible to convert existing video into 3-D automatically. DDD Group, based in Santa Monica, California, makes a conversion chip, called TriDef, that uses object-recognition software to analyse colours and shapes and determine distances, inferring that, for example, the muzzle of a gun is closer to the viewer than the shooter’s face. When the software is unsure it does not add depth, says Chris Yewdall, DDD’s boss.

One of DDD’s customers is Samsung, a South Korean electronics giant, which plans to launch 3-D television sets next year. DDD and its main competitors—JVC in Japan and NVIDIA in California—are also developing 3-D conversion technologies for computers. Acer, a Taiwanese manufacturer, is expected to launch a laptop equipped with a 3-D conversion chip made by DDD, in October. (Its display will require users to wear special glasses.)

SeaReal

An alternative approach to creating 3-D images is based on holography. A hologram is a special interference pattern created in a photosensitive medium (which can be as simple as a traditional photographic film). Light striking this pattern is scattered as though it were actually striking the object encoded by the interference pattern. The pattern is usually created by combining two laser beams, one of which has been bounced off the object being displayed.

Holograms have many advantages over stereoscopic images. Not only is no special eyewear needed, but also the images do not distort when observers move. But producing a fixed hologram of a static object is tricky enough; making a holographic display, or something that functions like one, is even more difficult. One approach involves firing carefully orchestrated pulses from an array of lasers at a sheet of glass scored with tiny grooves; another, demonstrated by researchers at the University of Southern California Graphics Lab, involves projecting high-speed video onto a rapidly spinning mirror, so that the appropriate views of an object are reflected in

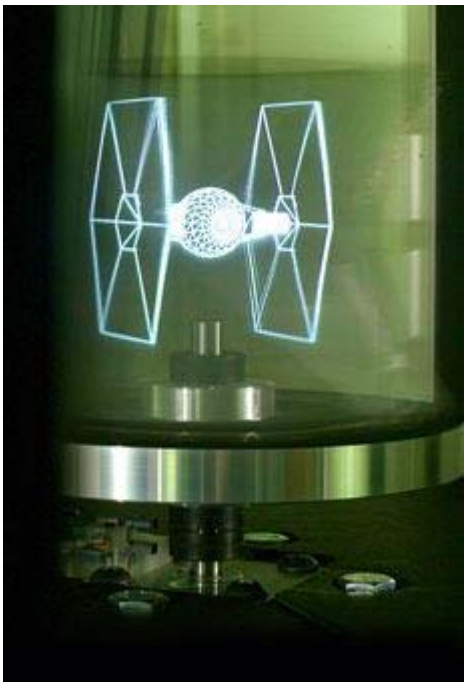
different directions. Such technology is still embryonic, but several industries are interested in it.

Reach out and touch

Kolpi, a French company based in Sophia Antipolis, has devised a 3-D display that will allow oil-exploration companies to direct their remotely operated submarines. Video and sonar data from the submarine are displayed as a volleyball-sized hologram. An operator can direct the robot by moving a cursor around inside the hologram. The display is expected to cost $140,000 when it goes on sale next year.

Actuality Medical, based in Bedford, Maryland, hopes to improve radiotherapy with a different type of 3-D display. At the moment doctors “hope the patient doesn’t move” as they zap cancerous tissue with a beam of radiation, says Gregg Favalora, the firm’s founder. Working with Philips, a Dutch electronics company, Actuality Medical has built an early version of a system that could limit damage to healthy tissue. Called Perspecta, it graphically depicts a simulated beam of radiation shooting through a hologram-like image of body tissue. This could eventually help doctors redirect radiation as body parts move slightly during treatment. The 3-D image is created by projecting about 6,000 images a second onto a nearly transparent spinning disc some 25 centimetres (10 inches) across, which forms a basketball-sized sphere.

USC



Almost close enough to touch: 3-D displays from Actuality Medical (top of article), SeeReal (second image) and the University of Southern California Graphics Lab (above)

Creating actual holograms—or images that resemble them, as Perspecta does—requires enormous amounts of processing power. So far this has kept images small: they are rarely bigger than a shoebox. To make them larger a company called SeeReal, based in Luxembourg, has built systems that use two eye-tracking cameras above a large 3-D display to follow the viewer’s eyes. It is then necessary to generate only the parts of the hologram that are relevant to the viewer’s position and direction of gaze, greatly reducing the amount of processing required.

SeeReal reckons that the information needed to construct small holograms can be carried over existing telecoms networks. That would allow scientists working in different locations to examine the same object, for example. Drugs companies, which are keen to improve co-operation between researchers in different laboratories, could represent a lucrative market for the technology within two years, SeeReal predicts.

Another obvious use for 3-D displays is videoconferencing. Accenture, a consultancy and research firm, has equipped two non-adjacent rooms at its research centre in Sophia Antipolis, France, with cameras so that a wall-mounted screen in each one serves as a window into the other. It is now using 3-D displays to allow people to “share” objects and data between the two rooms. The result, says head researcher Kelly Dempski, is an “extension” of each room into the other. As hologram and data-transmission technologies improve over the next decade, the rooms will increasingly meld together, he says.

Room with a view

Holografika, a company based in Budapest, hopes to realise this vision even sooner. One of its products, HoloVizio, displays 3-D images that “practically surround” users, says Peter Kovacs, the firm’s software chief. Its customers include carmakers and oil-exploration companies. Working with 13 companies and research institutions in America, Europe and Japan, Holografika is developing a system that will use holographic laser arrays, driven by data from about 100 video cameras, to

replicate the contents of one room in another. It is expected to cost about $500,000.

Another 3-D extension of videoconferencing is the Eyeliner holographic projection system devised by Musion, a company based in London. It does not actually use holograms, but projects high-definition video onto nearly transparent screens made of very thin foil, in a modern updating of the old “Pepper’s ghost” stage illusion. The effect, for viewers a few metres away, is a lifelike, full-sized 3-D moving image of a person that appears to float in space, without any visible screen.

Musion’s technology has been used by Al Gore, Bill Gates, Prince Charles and many other celebrities to appear on stage at conferences without being physically present. From televisions and laptop screens to operating theatres and conference halls, 3-D in all its forms is suddenly being taken much more seriously than it was just a few years ago.