

# Dancing Holograms

White-light integral holography has carried interest and exploitation of holographic movies outside the laboratory

BY JANET RALOFF

Tucked away in a sunny loft above West Broadway in New York City's Soho district — a warehouse neighborhood *cum* thriving art settlement — is the studio of Hart Perry Jr., cinematographer of the 1977 Academy Award winning documentary, *Harlan County, USA*, and president of The Holographic Film Co. The setting is simple and cluttered, its inhabitants young and enthusiastic. Here holographic inspirations take form, contracts for display ads are signed and a sampling of wares is displayed.

Perry is one of a growing number of holographic devotees instilled with the vision that this laser technology heralds a renaissance in still and motion-picture photography. But unlike most, he carries the skills and reputation to develop and market the medium. With exuberance he describes holography's growing acceptance as an advertising tool and means of artistic expression. Whether it is a fledgling industry or merely faddish space-age gimmickry will be determined by time and the marketplace.

Dennis Gabor received the 1971 Nobel Prize in Physics for his 1947 theory of holography, three-dimensional imaging. But the concept lay virtually dormant until 1962 when University of Michigan physicists Emmett Leith and Juris Upatnieks showed that coherent (laser) light could record a holographic image on photographic film. "This long delay between discovery of the theory and its experimental demonstration stemmed from the inadequacy of light sources before the advent of the laser," writes David D. Dudley in the 1973 NASA volume, *Holography*.

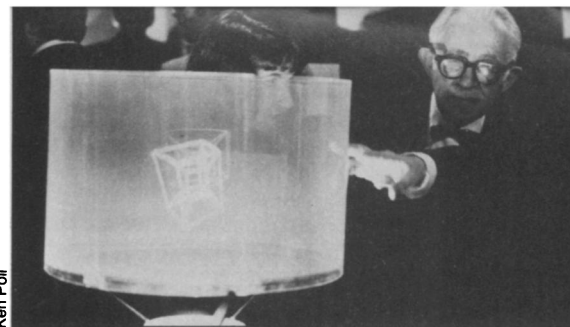
In their experiments, Leith and Upatnieks split a beam of laser light into two, an

object and a reference beam. When recombined, both the phase and amplitude of the interference pattern of the two beams were recorded on film, yielding a hologram. A reconstructed holographic image is three dimensional and gives the appearance of a solid object magically suspended in space.

The expense, technical precision and high-technology equipment required to produce the first holograms limited their use primarily to the laboratory. There, precise three-dimensional imaging was used for such things as nondestructive testing and particle-flow analysis. But early efforts were stop-action recordings — three-dimensional equivalents of photographs; movement was implied by comparing a sequence. Commercially marketed three-dimensional action — holographic movies — is a relatively new phenomenon. The advent of white-light, integral holography developed by Lloyd Cross around 1972 (drawing off the technique of white-light transmission holography and research into integral holography) made the medium relatively inexpensive and accessible to nonscientists — literally something anyone could buy and display at home. And here's where commercial artists like Perry entered.

Cross, a physicist who worked with Leith, is a former Soho resident who lived across the street from Perry. He also happens to be immersed in motion-picture holography and he turned Perry on to it. Cross told Perry that optical printers used to copy motion-picture film could be adapted to use lasers and print holographic movies.

Perry says he filmed one of the first commercial white-light integral-hologram movies — of Salvadore Dali and Alice Cooper — using conventional cinematic techniques. It was printed on one of Cross's machines. The holographic part of the movie-making comes in printing, Perry says, and he depended on his neighbor to reveal the technique to him. Cross later did over tequila, using a blackboard in a neighborhood bar, Perry said. Cross



Viewing white-light integral-hologram (a movie) of geometric form.

sketched the outline of a design. "It seemed so simple," Perry said. "We figured it would take three or four months to construct." It took two years. But now he joins Cross as one of the nation's few commercial holographic movie makers.

Those who saw the movie *Star Wars* were exposed to the holographic-movie concept: R2-D2 used it to project a distress message from Princess Leia. But the *Star Wars* image was not a real holographic movie, just a representation, and an advanced one at that. In fact, Americans weaned on Hollywood's best may be disappointed by the limitations of current holographic movies. They lack sound and true color. The angle of vision is so small that it precludes viewing by more than a few at one time. And most movies capture no more than a minute of action.

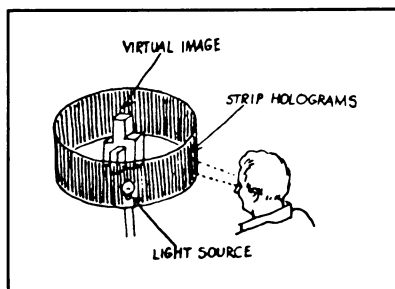
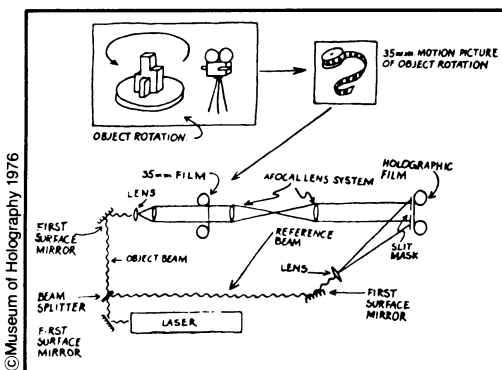
But they are one of the simplest and least expensive ways of projecting a moving image. The film is its own projector and an ordinary incandescent light bulb provides the illumination.

Holographic movies are made by filming a subject as it rotates throughout 120 or 360 degrees, using ordinary black and white film. The camera records a sequence of images; each represents three-degrees movement (or rotation) of the object.

In printing, a system of mirrors splits the initial laser beam into two. The object beam is directed via mirrors and lenses through the movie film and onto holographic film. The reference beam takes a separate path to the same holographic film. Resulting images are recorded as a series of vertical strips, each a fraction of an inch apart, on a long band of film. Developed film is displayed inside a clear cylinder and illuminated.

In viewing, each eye simultaneously looks through three or four image strips, or holograms, Perry says, but each eye views a different sequence, separated by perhaps 20 images. Walking about the cylinder makes the image move; as the viewer stops, so does the action. Several, including Perry, are designing more complicated viewing systems to mechanically advance film as conventional projectors do now.

Despite current limitations, moving integral holograms are becoming increasingly popular. McDonald's Corp., for example, is reported to be preparing a series of display ads featuring Egg McMuffins and Ronald McDonald. And Perry sees a growing market in moving portraits — especially of brides; he charges \$375. □



(left) Expose movie film of object rotated 360 degrees to laser light. View band of strip holograms inside cylinder.

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