Museum of the Fine Arts Research & Holographic Center

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HISTORY OF HOLOGRAPHY

Holography, like many great discoveries, is almost an accident. Searching for methods to improve the resolution of electron miscroscopy, Dr. Dennis Gabor, a scientist at the Imperial College of London, reasoned that by comparing the light shining through the object with a standard reference light he could record not only the brightness, but also the spatial relationship of one point of light to another. He made what is called a phase comparison. This is the discovery that makes Holography unique as a photographic technique. Using a mercury arc lamp with a green filter, he produced the first 'in line' transmission hologram in 1948. But despite Dr. Gabor's theorizing about the use of 'coherent' light, Holography lay dormant until 1960 when T. A. Mainman, of Hughes Aircraft company, demonstrated his first ruby LASER (Light Amplification by Stimulated Emission of Radiation) which produced an intense spectrally pure light. From then on scientific developments were rapid. Within a year Lloyd Cross sold the first commercially produced LASER, and Russian scientists produced the first white light reflection hologram. In this country, two scientists at the University of Michigan, Emmett Leith and Juris Upatnieks, used the LASER's coherent light to make the first holograms using an off-axis reference beam. Following this pioneering work, Dr. Tung H. Jeong, of Lake Forest College, in 1965, produced the first single shot, single beam 360 degree transmission hologram. Within several years Steven Benton of the Poloroid corporation had developed the white light transmission, the 'Rainbow' hologram, and Lloyd Cross and Dave Schmidt of the Multiplex company developed the white light 'Multiplex movie.' To house and encourage this work the Fine Arts Research & Holographic Center was founded in 1977, with its school of Holography opening in the fall of that year.

WHAT IS A HOLOGRAM?

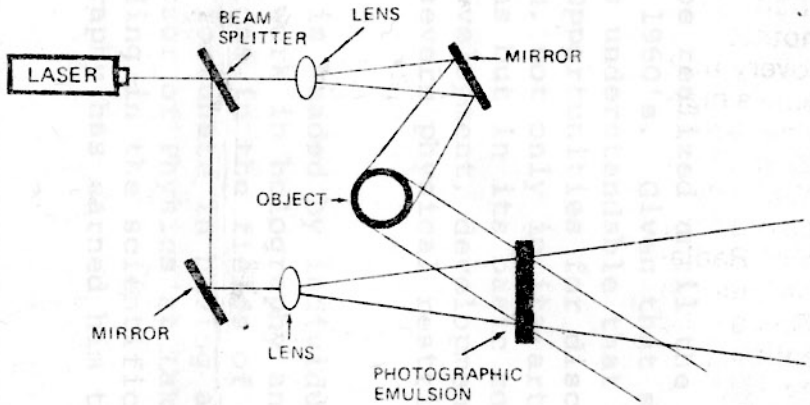
A Holographic plate and the image that plate produces are both referred to as a Hologram. A Hologram is actually a recording on a light sensitive medium of the light waves that reflect from an object illuminated with laser light, forming in complete and full dimension an image of that original object.

THE HOLOGRAPHIC PROCESS

What is the holographic process? Essentially, holography is an interference phenomenon depending upon the wave nature or oscillating fields of electromagnetic radiation. (Acoustic waves and seismic waves of sufficient coherence can also be used to form holograms).

Holography is a two step process. In the first step, the hologram is recorded. The second step consists of reconstructing the image.

During the recording process, laser light—highly coherent light—is used to illuminate the object to be holographed. The light reflected from the object is made to interfere in space with a second beam from the laser (usually derived from a beam splitter).



In that region of space where the two coherent beams interfere, a photographic emulsion is placed. All this is shown above in the sketch. The emulsion then records the interference pattern of the two beams. The emulsion—a black and white type of very fine grain—is developed in the ordinary way (developer, stop bath, etc.) and the first step is complete.

The second step, reconstruction of the image, is accomplished by passing monochromatic light through the hologram. The interference pattern recorded on the hologram, called a "diffraction pattern," bends part of the light or "diffracts" the light into a new direction. Because the diffraction pattern was formed using light reflected from the object, one would expect the light diffracted by the hologram to be closely related to the light reflected from the object. It turns out that the diffracted light is identical to the reflected object light. Therefore, one "sees" the object via the hologram exactly as one would see the real object via the reflected object light, with full depth and parallex.

This is all shown on the second sketch.