

"Pseudoscopic" Moldmaking Handy Trick for Denisyuk Holographers

by
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On 17 May this year, I gave an impromptu talk to a gathering of holographers in the evening at the Museum of Holography. No one at the time appeared to know how I managed to make a two-color reflexion hologram showing a red real-image hand in front of a dark green virtual image statuette, using only a HeNe laser and one sheet of Agfa 8E75HD film (it did in fact take many preparatory experiments before I made the hologram). The hologram created quite a degree of interest when on exhibition in Eindhoven, Holland and later in the "Laser '79" exhibition in West Germany. There were of course two tricks involved, and I will explain them separately. Firstly, how did I manage to make a real image hologram of my hand without using a pulse laser? A further interesting point about the way I did it is that it was much easier to make a real image than a virtual one, which is of course quite the reverse of general experience.

This was how I did it: I made a "pseudoscopic mold" out of plaster of Paris. I added 420 cubic centimeters of ice-cold water to one kg of "dental grade" plaster of Paris and mixed it well while wearing rubber gloves. After precisely one minute I removed the gloves and quickly poured the mix into a square polythene container. At this moment the mix had a putty-like nature and was stiffening rapidly. I pushed my left hand in so that the fingers were half immersed at the back of the hand and held it steady while with my other hand I removed any bits of plaster which overlapped and formed what industrial molders would term a "re-entrant angle." A "re-entrant" angle prevents a solidified object being removable from a rigid mold and for holographic purposes prevents light from reaching the inner areas of the mold behind the re-entrant angle (it also imprisons the hand. My first experiment was to put both hands in plaster at the same time. I had so many re-entrant angles that I could pull neither hand out and was effectively handcuffed in a plaster of Paris block. It created some considerable laughter when my wife watched me having to smash the block on the pavement outside in the street to free myself).

I found that 10 minutes was enough for the block to set hard enough to be able to remove my hand without deforming the mold. It was slightly painful because the mold trapped small hairs from the skin, but these hairs did add to the final realism of the hologram (I have tried using more modern molding material but its inherent surface reflectivity was very inferior and reacted badly when I tried to improve it with a light coat of white spray paint).

A peculiar problem I found with plaster of Paris was connected with the need to dry out the excess water. I could either obtain holograms from the mold when it was freshly made and full of water or when it was well dried, but not obtain good holograms during the many days it took to dry out. I put this down to an irregular contraction process occurring of the order of $\frac{1}{2}$ a wavelength of red light during the 20 or so seconds of time needed with my HeNe laser. One can judge if the drying process is complete by weighing. One kg of the original powder should finish up weighing 1.2 kg. when dry.

When my mold was dry I squeezed my hand back into it tightly and sprayed black paint all over it and the mold. After a few minutes I removed my hand and left the mold looking like a white shadow on a black background (see picture). To actually use this pseudoscopic object, I placed it close up to the film upside down and exposed it to a single beam in a simple Denisyuk arrangement. The resultant hologram is then viewed on the same side as that which faced the pseudoscopic object.

Now to deal with the trick of obtaining two colors using only a HeNe laser. Firstly I had to use a processing system which would roughly reproduce the original red illumination in white-light viewing (such as Steve Benton's system in *holosphere*, July 1978, p.4).

The procedure I contrived was as follows. Firstly, to expose the hologram to the pseudoscopic hand for an exposure time three times longer than would usually be sufficient. Without further treatment to develop the latent image, I then soaked it in a solution of 12 per cent triethanolamine and blotted the film on a fresh and new piece of unfolded or uncreased blotting paper, pressing evenly over the back of the hologram. The much-increased exposure time was needed because I found the latent image was apparently much weakened by this triethanolamine swelling treatment. The blotted film was left in a dark room at 25°C for an hour before making a second exposure. Since I required an ordinary virtual image on the second exposure, the emulsion side was positioned the opposite way round and upside down with respect to the first exposure. The object was then placed in a predetermined position with respect to the film. The exposure time was then in the second case only $\frac{2}{5}$ of what it would normally have been, because the emulsion had been sensitized both by the triethanolamine and probably also by the first exposure.

After developing and bleaching as usual, the triethanolamine was completely removed and therefore the gelatin contracted to its usual thickness, decreasing the wavelength of the viewing light for the second exposure but leaving the viewing light of the first ex-

posure in the red. The result was an interesting superposition of a real-image red hand in front of a virtual green figurine. In my experiments I did not find that reversing the order of exposing by first leaving the emulsion swollen and later unswollen gave as good a result.

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who wants to work in integral holography directly must be willing to acquire their own printer. BUT when you do, BUILD TWO, one for the commercial jobs that will pay the rent and meet the rising cost of living, and one you can rearrange to suit your own vision as an artist.

Sharon McCormack is a holographic stereographer and is a member of the San Francisco School of Holography.

Answer:

Integral holograms do not yet have the elegant finished look of a well-executed plate hologram. The integral system, making use of movie film, has great possibilities for innovative imagery.

I enjoy the integral process and have worked consistently for myself and clients. "For My Father" and "Self-Portrait as a Smearing Carpenter" are two 360° integrals that regardless of all drawbacks I feel are finished pieces and am proud of.

I am still very interested in integral holograms. Recently I changed format to the "minigram." This system improves image quality, cleans up the packaging and makes holograms more accessible.

Abe Rezny is an independent commercial/artistic holographer.

Answer:

Everything is a viable art form — the problem, as with holography, is expressing one's identity and concerns successfully.

Integral holography is a tenuous art form because its difficult technology limits access and often results in an overemphasis of technology.

You can say it in 3D and with mystery.

"Inches" from serigraph laser scan calligraphy. c1979 by Peter Van Riper.

Peter Van Riper is an artist who has worked extensively with lasers and holography, among other media.

"In fact, telephone systems will become so intelligent that phones will function like computers. And perhaps, by 2029, what science writer Isaac Asimov calls the ultimate communications system — holographic projections with two way-sensory circuits — will be unveiled." *Business Week*, Sept. 3, 1979.

Holographic techniques were used in the design of a new Hi-Fi speaker system being marketed by Rank Hi-Fi, Inc., 20 Bushes La., Elmwood Park, NJ 07407.