Mixed Media: Holography Within Art

Martin Richardson

Abstract—The author discusses the role of holography as a fine-arts medium, with particular reference to his work in mixed-media, holography, photography and sculpture.

Fig. 1. From the series Triangle in Landscape, 1981. A mirror sculpture has been placed on the shore of a lake in Hampstead, London.

The hand touched a plane surface; and the eye, still allured, saw a relief; so that one might have asked the philosopher which of the two senses whose testimonies contradicted each other was mendacious.

Diderot, Salon of 1761

I. INTRODUCTION

In 1979 I attended a lecture by Paul Walton and saw my first hologram. It was quite small, but for me it was one of the most exciting things I had ever seen. Not long after this, I attended an exhibition of holographic artworks called “Light Years” [1]. Although I had already become interested in the creative possibilities of holography as a result of Walton’s lecture, I was unprepared for the impact of these images, up to a metre square and dazzlingly clear and bright. The following day, still deeply impressed by what I had seen at the exhibition, I learned that a ‘Holography Workshop’ was about to be opened to the public. I immediately applied to be enrolled in a course in practical holographic technique. This article describes how my work and attitudes toward art have developed since then.

For the reader unacquainted with the techniques of holography, I should explain that a hologram resembles a photograph in that it provides an image of a subject recorded on a photographic film or plate; however, by using the coherent light from a laser to illuminate both the subject matter and the plate, the whole information about the subject matter is recorded (hence the name ‘hologram’). Furthermore, this information can be recorded without a lens. Since a hologram preserves the three-dimensional information that is lost in a photographic image, a holographic image is fully three-dimensional; thus it may be thought of, at a crude level, as relating to a photographic image much as a sculpture relates to a painting [2]. To display a holographic image it is only necessary to illuminate the hologram with a spotlight. Depending on the lighting arrangement at the time the hologram was made, this spotlight needs
to be positioned either in front of the hologram ('reflection') or behind it ('transmission'). The simplest type of hologram, a single-beam or Denisyuk hologram (named after its inventor), is made by placing the plate immediately in front of the subject and illuminating the subject through the plate (which is transparent). The plate is then processed in somewhat the same way as a photographic film, and the image is viewed by reflected light [3].

In a first-generation hologram, the image is always virtual, i.e. behind the hologram, much as if one were looking through a window. Of course, if all holograms were like this, it would be logical to argue that as the aesthetic experience of viewing a hologram is no different from that of viewing the subject, one might as well look at the original subject. (Indeed, it has become an established practice in the Soviet Union to exhibit holograms of art objects that are too precious to be put on public display.) One can make a further hologram of this holographic image and, like a creative photographer working with an enlarger, modify the image in the transfer. For example, the image can be changed in hue, distorted in shape, superimposed on another image, brought out in front of the hologram as a real image and even made pseudoscopic, i.e. with reversed perspective.

II. FROM SCULPTURE TO HOLOGRAPHY

My early background as an artist was as a sculptor. I began to introduce holography into my work as an experiment in the integration of creative media. The ability of the holographic image to make an immediate impact on the viewer interested me more than its theory or technique.

I conceived my first holographic works as landscape pieces. I designed them to be seen in natural open spaces such as public parks in urban areas, grassland and woods. Rural motifs relating to the change of seasons provided the subject matter of the holograms; for example, in an autumn composition, I used the simple motif of falling leaves against a red background.

I found myself comparing the way I understood the holographic illusion—my attitude toward its qualities of space, depth and time—with similar concerns I had had while making mirror sculptures. These concerns fitted into a conceptual framework analogous to contemporary ideas being expressed by artists such as Richard Long and Robert Smithson, especially in the latter’s Mirror Displacements. Unlike Smithson’s work, my own mirror sculptures featured triangular shapes that interacted with their surroundings and achieved a geometric balance in what could have been a confusing disarray of reflections.

In art history, spatial ambiguity has often figured in the approach to visual disciplines. Although I have never consciously had this goal in mind, some of my ideas concerning landscapes may have been rooted in this type of visual deception. An example of this is the series Triangle in Landscape (see Fig. 1) [4]. I worked on this project concurrently with my first holographic landscape pieces and based it on the theme of grassland/swamp: mirrors of various shapes reflect treescapes and water. One may interpret these as segments of space taken from shapes in

Fig. 2. Triangles in Landscape, with Hologram, reflection hologram, 10 x 8 in, 1983. (Collection of the Museum of Holography, New York) Above, a hologram has been cut into strips to form the shape of a triangle; below, contained within the frame are pages from a sketchbook, segments of a hologram and photographs.

Fig. 3. Behind Glass, holograms with mixed media, 1983. This mixed-media assemblage consists of three 4 x 5 in holograms, two colour photographs (centre of each outer column) and two flattened tin cans, all mounted on Ingres paper.
my earlier experimental paintings in which I dealt with traditional problems of perspective and form. Camouflaged by their surroundings, the mirrors themselves are invisible—as mirrors are, by definition. The scanning eye sees a multitude of spatial shifts, forms that fold and unfold, contrasting simultaneously both the reflection and the shadows of the space around and beyond.

The holographic mixed-media piece Triangles in Landscape, with Hologram (Fig. 2) is an observation of the way time affects a particular area of land and alters the way it relates to a particular shape or form. For example, I visited a small area of grassland at regular intervals over a year. On each visit, I would photograph the scene twice: first in its natural state, then as altered by me to include the shape of a triangle. During the winter, I cleared away the snow from an area of ground to reveal a bright green grass triangle, its outline emphasized by a broad white border of virgin snow. Without moving earth or changing the character of the selected area, I subtly shifted the natural surrounding elements to form a geometric shape, thus altering the viewer’s awareness of the scene to emphasize a simple idea to the maximum. During the autumn, in a similar maneuver, I gathered leaves from the surrounding trees to form a triangle. The concepts behind my efforts to capture these activities came together in Triangles in Landscape, with Hologram.

In the words of Rene Barilleaux:

Landscape tradition has always been diversified and open to new interpretations readily adaptable to new media such as holography. Holography’s ability to recreate depth and volume makes it well suited to landscape subject matter. It can go beyond the mere recording of nature to produce a unique integration of light and space.

I designed the series of holograms entitled English Oak to be lit by sunshine rather than by conventional gallery lighting. The main elements of these works are the real bark of the trees and the 8x10-inch reflection holograms surrounded by the bark (Color Plate No. 9). Each hologram has an image volume of approximately 2 cubic feet. In this holographic space, detached leaves and twigs appear to float, submerged in red light. The subject matter appears in silhouette, producing an effect similar to that of looking up into the branches of a tree at sunset. The illusion is heightened by the juxtaposition of the hologram with the real bark framing it. Unsuspecting viewers may think that the hologram is a box illuminated with red light, not realizing that the hologram is actually a flat surface and that it creates its image by behaving somewhat like an optical mirror, i.e. it actually focuses the rays from the sun into an image by diffraction.

III. SPACE, FANTASY, ILLUSION AND HOLOGRAPHY

A hologram is made up of millions of tiny particles of silver, which diffract light so that they replay a moment from the past, locked within the photographic emulsion. English Oak presaged the direction that my work was soon to take. I wanted to displace the notion that art objects, especially holographic art objects, are somehow immune from their surroundings and exist in a different kind of space from the space occupied by the viewer.

Space, and the way in which artists fill it—be it sculpture, architecture or sound—involves design criteria specific to the act of description. The aesthetic bond between these criteria and holography is recognized by artists who share...
similar concerns, i.e. developing three-dimensional space. Subsequently a sculptor or architect is more likely to respond to holographic images than are individuals involved in two-dimensional imagery.

If one considers the traditional methods of the fine arts for producing the illusion of space, one finds that an essential factor in obtaining the illusion of depth is the way in which the sense of space is conveyed. To quote Miriam Milman on trompe-l’œil art:

A whole body of empirical or mathematical methods [has been employed] to produce in the work the illusion of that third dimension which is essential to the world around us. However, the spectator has to exercise his own will in order to enter this ‘fictional’ world. Once he has entered he finds himself in a context where content may strike him more or less fruitfully [6].

In critically analysing three-dimensional imagery we are compelled to make compositional decisions relating to ‘real time’ and ‘real space’. The way we perceive the physical presence of an object and identify its origins determines our conception of its structuring in terms of material, weight, density and placement—if the image is holographic we may mistakenly continue to employ these criteria. Fundamental concepts of visual orientation such as ‘up’, ‘down’, ‘left’ and ‘right’ fall apart when applied to holographic imagery and so no longer function as tools for the cognitive process of familiarity and dissimilarity, fact or lie about our world. The concept of fantasy is essential to holography since only in fantasy can this illusionary world be translated into convincing evidence that the holographic image is, in fact, realistic.

The two most important geometric rules that dominate traditional perspective, depictions are: (1) horizontal and vertical lines parallel to the plane of the picture are depicted as horizontal and vertical lines (equal distances along these lines are shown as equal distances in the picture), and (2) parallel lines that recede out of the plane of the picture are depicted as lines passing through a single point (the vanishing point).

One of the most convincing depictions of these rules was made in 1952 by the Dutch artist M.C. Escher [7]. In his lithograph Cubic Space Division, Escher’s sole aim was to depict an infinite extent of space. He used no means other than the laws of classical perspective. The viewer sees the infinite extent of space through a square window; but as the space is divided up into similar cubes by bars running apparently in three dimensions, a suggestion of the whole is achieved. The ‘exercise of the will’ suggested by Miriam Milman is an interesting point but applies only in the context of traditional pictorial perspective laws as exemplified by Escher. In holography, these pictorial laws can be ignored, as it is in the very nature of the medium to offer a real perspective space within which one can observe genuine spatial relationships. Likewise, I suggest that a temporal spatial frame also marks off the special kind of reality one experiences when looking at holograms. The analytical structuring that we normally apply when categorizing things forms clear boundaries within which we can operate. However, in the case of holograms they have a non-function—

and a framed hologram can look ugly or crude.

IV. TOWARD A NEW AESTHETIC

When conceiving a hologram, one cannot easily achieve a balance between technical skill and artistic merit (unless one concludes that these values go beyond artistic merit). Yet these values have to be balanced if the work is to communicate a clear presentation that avoids the stigma of ‘high-tech art’. The subject matter forms the basis by which one expands and amplifies one’s ideas and thoughts; it is a mantra of concentration and opportunity. Whether the subject matter is pre-visualized or spontaneously evoked is irrelevant—it is the meaning of the subject matter that should be approached critically. Holographic images must not be allowed to seduce the viewer through their technical facility alone; on the other hand, a holographic image of artistic merit can be stultified by poor technique. A conceptual framework for establishing aesthetic criteria for evaluating holographic art can be made without moving far away from those of other media such as photography.

The use of holography as a medium integrated with photography is worthy of discussion, as it demands a direct comparison between the two expressive media. The juxtaposition of a photograph alongside a hologram presents two contrasting illusions of reality, a quality I explored in my mixed-media piece Behind Glass (Fig. 3). A crumpled tin can provided the image for exploring the dual nature of these representations of the same object; two crumpled cans were presented alongside the holographic and photographic recordings. In conceiving this work, I took into consideration its presentation as a piece, in particular the contradiction of the entire assemblage’s being framed behind glass; the real flattened cans become almost two-dimensional like the photographs, leaving the liberated holographic images unconstrained to project themselves into space behind the glass.

The three holograms provide an illusion of a space receding beyond the actual plane of the framed glass; this is immediately countered by the flatness of the photographic image. The holograms seem to become isolated through their juxtaposition with both the real cans and the photographs, which seem to have more substance than the floating holographic replicas. Having accepted the content as ‘possible’, the viewer is led by the realism of the details and of the space they occupy to accept the illusion of reality. Needless to say, many viewers find this acceptance troublesome. People often reach out and touch holograms to test the reality of their vision.

My most recent work involves the use of a pulsed laser; this has made it possible to create holograms of live subjects. To this end, I have incorporated human features such as chins and noses into a geometric form, again the triangle. Inner Space (Fig. 4) is the title of one of these recent pieces. This pulsed hologram [8] is part of a series. The human form and geometric shape combine in a design of intersecting planes that fall in and out of view, seen and unseen, hidden and revealed, like a ghost playing hide-and-seek. The work is an array of rainbow colors; it exploits the advancing quality of red and the receding quality of blue. The design, which occupies a clear position in space parallel to the plane of the glass, is projected as if pushed out from the centre of a solid to reveal yet another triangle in the form of a window with a man’s face beyond. Implicit, explicit and suggested depth reveal another world.

Acknowledgment—I should like to acknowledge the help of Graham Saxby in preparing this article.

REFERENCES AND NOTES

1. This exhibition was presented by Sue Davis, Director of the Photographers’ Gallery in London, England, in collaboration with Eve Ritscher.

2. In simplest terms, a hologram is a three-dimensional image—a recording of laser light patterns reflected from the surface of an object or scene. Unlike photography or painting, holography renders an object on glass or film with complete dimensional fidelity. A hologram recreates everything seen by one’s eyes—size, shape, texture and relative position; however, if one tries to touch the image, all one will find is focused light. The principle of holography was discovered in 1947 by the Hungarian
physicist Dennis Gabor. In 1960, the invention of the laser provided a pure, intense light that was ideal for holography. As a result, holographic techniques and applications in science and industry mushroomed. Artists were introduced to the medium in the late 1960s and have become increasingly active in the field. Their efforts have expanded the public awareness, technological insights and creative dimensions of the medium. Holography has become a unique and special form of communication. ("Holography Information Sheet", Education Department, The Museum of Holography, New York City.)

3. Based on the 1962 work of Y.N. Denisyuk in the Soviet Union, reflection holograms selectively reflect light from a white-light source on the same side as the observer, allowing them to be hung on walls or worn as decorative jewelry. They present a full-parallax 3-dimensional image, so one can look over and under as well as around objects in the image. Two general classes are often seen, distinguished by the width of the colour spectrum they reflect. See Stephen A. Benton, "Survey of Display Hologram Types", SPIE 353, Industrial and Commercial Applications of Holograms.

4. This image was used as the cover for the Royal Photographic Journal (April 1986).


8. Rainbow holograms, also known as 'Benton' holograms, were invented by Stephen A. Benton at Polaroid Corporation in 1968. They accept illumination by white light to provide bright, clear, sharp and deep images. In exchange for the reduction of source coherence, the information content of the image must be reduced by omitting its vertical parallax: one can no longer look over and under objects to see what is behind them, although the view around is retained, as are the rest of the binocular cues to depth. Thus, observers almost never notice this omission, and for them the most apparent characteristic is a pure spectral image colour that varies as they move up and down and back and forth, or perhaps a rainbow spectrum over the image as each colour component of the white light is optically separated to form its distinct image. The observer must be within a particular zone in front of the hologram and not too close to it for the clearest viewing. (Information based on material found in Benton [3].)

Editor's Note: For further reading on pulsed holography see Margaret Benyon, "Pulsed Holography As Art", Leonardo 19, No. 3, 185-191 (1986).
Call for Papers

Holography as an Art Medium

The Editors of Leonardo have announced a call for papers in the area of holography and its use as an art medium. Artists, scientists and engineers are invited to send proposals for manuscripts. Technical articles reporting on the technical state of the art as well as articles by artists using holography are encouraged. Theoretical and critical discussion is also welcome.

The Editors believe that by the next turn of the century holography will fulfil its promise as a new art medium. Crucial developments are occurring in computer generated holography, pulsed holography, animated holography, large format holography, fiber optics, embossed holography and full color lasers. These developments will make holography more accessible to artists and will allow artists to gain technical control over the medium. These developments should allow artistic goals to begin to dominate over technical considerations.

In addition to publishing more articles on holographic art, the Editors are planning a special issue to be published in 1988. Further information will be provided on request.

PUBLISHED IN LEONARDO

MARGARET BENYON with JOHN WEBSTER: Pulsed Holography as Art, 19, No. 3 (1986).
MARGARET BENYON: On the Second Decade of Holography as Art and My Recent Holograms, 15, No. 2 (1982).
MARGARET BENYON: Holography as an Art Medium, 6, No. 1 (1973).
HANS WICHELMSSON: Holography: A New Scientific Technique of Possible Use to Artists, 1, No. 2 (1968).

Copies of these individual articles are available at a nominal cost by writing to I.S.A.S.T., P.O. Box 421704, San Francisco, CA 94142, U.S.A.

No. 2. Top right. Jean Kápera. Demain temps doux et nuageux, luminous newspaper; perforated kraft paper bands, transparent plastic sheet support, colored inks, intermittent back illuminations; 1.5 × 1.35 m; 1965.

No. 3. Center left. Crystal Woodward. Le Bouquet d’Arbres, oil on board, 16 × 13½ in, 1981.

No. 4. Bottom left. Samia Halaby. For Nihau from Palestine (detail), acrylics on canvas and wall, 1985. The complete work measures 14 × 18 ft.

No. 5. Bottom right. Martin Richardson. English Oak, reflection hologram, silver halide on 8 × 10 ft glass plate, 1982. (Collection of the Museum of Holography, New York)
Forthcoming in *Leonardo*
Volume 20, Issue 4–1987

**ART OF THE FUTURE — THE FUTURE OF ART**

20th ANNIVERSARY SPECIAL ISSUE
In commemoration of Frank J. Malina

**TABLE OF CONTENTS**

Editorial
FRANK POPPER: Technoscience Art—The Next Step

Synopsis of the Journal's History

Feature Articles
RUDOLF ARNHEIM: The State of the Art in Perception
ARTHUR C. CLARKE: *The Songs of Distant Earth*, Excerpt
MYRON A. COLER: Creators of Environment
FRANK DIETRICH: The Computer: A Tool for Thought Experiments
MICHELE EMMER: Soap Bubbles in Art and Science: From the Past to the Future
HERBERT FRANKE: The Expanding Medium: The Future of Computer Art
ELIZABETH GOLDRING: *Desert Sun/Desert Moon* and the SKY ART Manifesto
ANTHONY HILL: About the Immediate Future of Modern Art
PETER LLOYD JONES: Curators, Creators and Consumers
I. ROBERT MAXWELL: The Future of Publishing
LARRY POLANSKY et al.: The Future of Music
JASIA REICHARDT: Machines in Art
Cyril Stanley Smith with Pauline Boucher: The Tiling Patterns of Sebastien Truchet (1704)
STEPHEN S'SOREFF: The Malleable Memory of *Avant Garde Art Review*: A Post-Conceptual Artwork
ALVIN TOFFLER and JOHN McHALE: The Future and the Functions of Art

**INDEXES**

20-Year Cumulative Subject and Author Indexes to be published in conjunction with the Special Anniversary Issue