HOLOGRAMS
AND
LASERS

An Experimental Exhibition Exploring Techniques and Applications of Modern Optical Technology as Art Media

Prepared By
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Introduction

This proposal discusses an experimental exhibition of laser pieces and holograms to be prepared by Editions Inc., of Ann Arbor, Michigan, for the Contemporary Wing of Finch College Museum of Art in New York City. The purpose of this exhibition is to explore the potentials for using advanced laser and optics technology as art media. Such a definitive artistic exploration of lasers and holography, as is planned, would fulfill a much needed educational as well as aesthetic purpose for a public intensely interested in modern technology and it's applications to art media.

This proposal contains a description of the planned exhibition pieces as well as a summary of costs associated with preparing them and mounting the exhibition, as well as information concerning Editions Inc. and it's staff.

The artist's constant endeavor is to create an aesthetic reality from the divergent and informal events of his life and culture. He is dependent upon the world of his experience and upon the technology of his age for his media, the vehicle of the experience. Though it is a common attitude that art and technology are antithetical, in reality artists have always sought the best material available, be it a more evenly grained marble, a new metal or casting process or a paint that will not fade or turn color. Thus, despite the presumed antipathy of art to science, the history of art media is also a history of technology. The artists of this age are fortunate in having not only the benefits of the traditional media, but also of the amazing advances that science has made in one generation; plastics more durable than marble, acrylic paints that are unfading and much more durable than oils, computer graphics, neon tubes and, perhaps most interesting of all, lasers and holography.

The application of lasers to existing art media allows a realization of the artist's traditional attempt to control light, an ambition as old as man's first use of color, and, in one case, that of holography, provides an entirely new art medium. The special property of laser light that makes this possible is it's coherency, which refers to the fact that in laser light all light waves are in phase with one another. The coherency of laser light also means that it is highly directional, whereas ordinary white light is diffuse, and it is monochromatic, thus providing a source of pure color unobtainable in nature. This directional, monochromatic, coherent light source is required in the medium of holography.

Holography is a process of recording and visually reproducing an object or scene in three dimensions, as opposed to conventional photography which records in two dimensions. The word "hologram" comes to us from two Greek words meaning "whole" and "message." The "whole message" is an accurate description of a hologram. Whereas a photograph presents an image in a flat, two dimensional space, a hologram presents an object in depth, as it would appear if you were looking at it through a window. When viewing holograms, you are able to see around objects in the foreground and peer above and below objects in the hologram with a shift of your head.

To make a hologram, a laser beam is divided into two parts, one part going directly to a photographic plate, the other part illuminating the object being holographed. The light striking the object scatters off of it onto the photographic plate where it interferes with the light coming directly from the laser, resulting in a fine pattern of light and dark lines on the photographic plate. This interference pattern between the two parts of the same laser beam is an exact record of the way in which the light coming from the object struck the plate.

After the plate has been developed, proper illumination of this interference pattern reconstructs the light exactly as it came from the object. The final, fully three dimensional image you perceive is not formed on the plate, but in your own eye, as if you were looking at the actual object.

The pioneers of holography were Emmett N. Leith and Juris Upatnieks of the University of Michigan, Ann Arbor, Michigan, and Dr. Dennis Gabor of the Imperial College, London, England. They speak ably on the history of holography and it's potential:

"In 1948, the first paper on holography was published. The author, Dennis Gabor, had discovered that by means of a coherent background or reference wave, he could record the phase as well as the amplitude of light waves; furthermore, from this record he could recreate, with considerable exactness, the original light wave pattern. Since this announcement, holography has prospered and expanded into an astonishingly diversified activity. Our own efforts, which began in 1960, resulted in the attainment of high-quality imagery of arbitrary, three-dimensional objects, and thus demonstrated the enormous potential inherent in the holographic process."

Emmett N. Leith
Juris Upatnieks

"The explosive development of holography which started in the early 1960's at the University of Michigan with the work of E. N. Leith and J. Upatnieks, was a great pleasure for me and a great surprise. I discovered the basic principle of wavefront reconstruction of a hologram (that is to say, from an interference pattern of a known "reference" wave and an unknown "object" wave) in 1948, in an effort to improve the electron microscope. The principle was in hibernation until the advent of the laser, for lack of powerful sources of coherent light, and by 1962 I had booked it off as one of my many failures. Since that time, ingenious physicist and engineers have discovered a startling number of applications; they have realized almost everything except what I set out to do in 1948: seeing atoms! Only <u>almost</u>, because some of the most important practical applications are yet to come; in information storage, data processing and entertainment. In holographic art, the most important step is also one which has not yet been realized; <u>Panoramic holograms</u>: three-dimensional scenes in natural colors, created by artists, which give the illusion of extending freely into depth, to the horizon."

Dennis Gabor

Artists do have an obligation to humanize their culture, to demonstrate that technological progress need not be destructive and that works of beauty and integrity can evolve from science. The commonly held fear of lasers as "death rays" for example, ignores not only the application of laser to the creation of art, but to medicine, engineering and communication. A definitive exhibition of explorations in lasers and holography would fulfill an educational as well as aesthetic need.

Furthermore, due to the impact of space travel and the spectacular advances in all brances of science, the public has shown an extreme interest in technology and technological art media. Exhibitions of technological art media have been extremely well attended from "The Machine as Seen at the End of the Mechanical Age" at the Museum of Modern Art in 1968, to the Editions Inc. exhibition at the Cranbrook Academy of Art, which, according to the Director, Mr. Wallace Mitchell, "... has broken all attendance records."

For the Contemporary Wing of Finch College Museum of Art, Editions Inc. envisions a two part exhibition. The first part would be an instructional display in the lower gallaries of Finch College Museum and the second part, an exhibition of holograms and laser pieces as art media. The instructional display will be logically arranged, beginning with the history of artificial light sources: candles, incandescent bulbs, flourescent and neon tubes and lasers. Each light source will be explained and the public will thus be able to understand the laser in its proper context as a source of light. Another instructional display will deal with the history of holography, explaining how the holographic process works and demonstrating a holographic camera. Next will follow a photographic exhibition of laser applications in the areas of medicine, communication and industry.

The public will then have acquired sufficient knowledge to more fully appreciate the art exhibition which they will find on the second floor gallaries. This exhibition will include holograms and assorted laser pieces presented as art media and will be as follows:

1. Approximately 20 holograms (8" by 10" and larger). These holograms will explore virtually all holographic techniques, ranging from projected real images of objects floating in space, to the creation of surrealistic landscapes extending to infinity. The plans also include multiple image holograms, in

which the subject changes according to the spectator's angle of view; holograms of scenes or objects which could not be constructed in reality but can only exist in a three dimensional holographic reality; holograms of pure spectral color existing in depth.

2. A holographic jig-saw puzzle for interaction with the viewers.

3. A four-color laser sound piece composed of a 500 milliwatt krypton laser, modulated beam projected onto the inside of a frosted dome and totally coordinated with taped and environmental sound.

4. A pulsed infrared laser and KDP crystal which will produce a pure green light beam without apparent source generated through a system of folding mirrors.

5. A 10 milliwatt helium neon laser projected onto a monitored screen with photocell and optical scanner. This interactive piece produces a stationary pattern operating in a complex but predictable manner.

6. An environmentally reactive laser piece consisting of a 3 milliwatt helium neon laser and front projection screen. This piece uses optical feedback and environmental sound to generate self-controlled paterns.

7. A laser "sparkle" chamber which will consist of a portion of a 500 milliwatt krypton laser beam, completely enclosed in a plexiglas box containing scattering particles.

8. A laser skylight which will involve a 3 milliwatt helium neon laser and plastic spatial structure.

9. A 3 milliwatt helium neon laser and acrylic tube filled with liquids of varying viscosity. The surfaces of bubbles are used as lenses to defract the laser beam.

10. A portion of a four-color krypton laser will be used to generate lumia-type patterns exploring specific and particular properties of a laser beam.

Editions Inc. is, of course, concerned with the safety and reliability of the exhibition. Our exhibition at the Cranbrook Academy of Art in Bloomfield Hills, Michigan, has been a model of reliability and safety. We will submit detailed plans to the New York City Health Department and will, of course, cooperate in every possible way with Health Department officials. The exhibit will adhere to the standards set by the National Committee on Laser Safety and in no instance will a direct laser beam come in contact with the public. A technician will be available throughout the exhibition to insure the complete reliability of the equipment.

The exhibition has been conceived of and will be mounted by the staff of Editions Inc., assisted by a panel of advisors in the areas of art, technology and museum exhibitions. A list of these advisors is appended.

Editions Inc. is a group of artists and scientists who are deeply involved in applying technology to art. We were initially brought together in Ann Arbor, Michigan, by our mutual interest in the artistic potential of lasers and holography. Ann Arbor is, of course, one of the great research centers of the United States, but more specifically, it is the birthplace of and the major

center for holography in the world. Thus, our artistic interests are harmonious with our exciting technological community. At present, Editions has the world's first non-industrial holographic studio whose doors are open to artists interested in pursuing holography as an art form as well as those interested in gathering information on the uses of lasers as art media.

The initial thrust of Editions Inc. has been in the area of holography. In the exploration of this medium artists work with scientists or alone to produce finished holograms. Individual holograms of a subject are signed by the artists designing the image and by the holographer making the plate. We are now making holograms in limited editions, each one signed and numbered by the artist and the holographer. Editions therefore has created and developed a new graphic medium: holography.

Editions Inc. has plans to become a base for information on art and technology available to all interested artists and scientists. Future areas to be explored include plastics, computer graphics and multi-media techniques.

Editions Inc. is a young company with the capability and desire necessary to vigorously explore the potentials of advanced optical technology as art media. It feels that such explorations are vital in order to create a more visually stimulating, imaginative and ultimately, a more humane society.