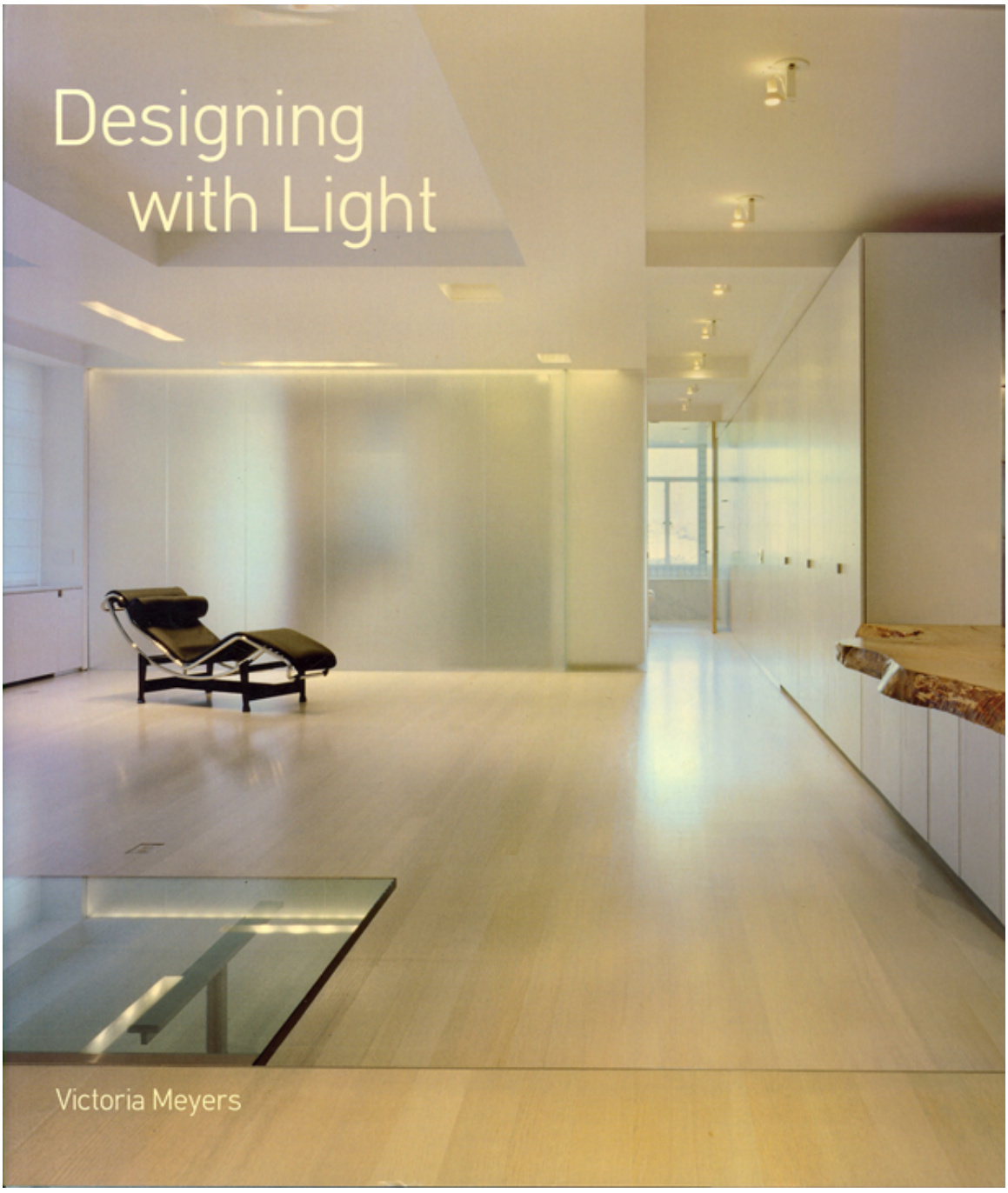

Designing
with Light
Victoria Meyers

Designing with Light

A Cross-Disciplinary Approach

Mary Temple
acrylic paint on existing interior wall surfaces.

LIGHT

In my practice, hanrahanMeyers architects, we have pursued investigations into light as an area of special interest. Light goes hand-in-hand with architecture, as it does with many of the arts. We have pursued light by developing new window and skylight prototypes, and through the use of color both as a direct and reflected medium in our projects.

This area of interest is directly connected with vision and visuality. Light can create illusions of depth of field. It can create drama, a sense of openness, and a sense of spirituality. Vision is our primary means of reading our world.

We live in an age when 'light' as a concept is challenged as never before. In the eighteenth century, discoveries were made about the refraction of light. At that time it seemed a miracle that something as clear as 'white' light, when bent through the medium of a prism or a raindrop, would yield color. Today our concept of light, along with other natural phenomena, continues to be tested and altered by science.

Einstein's theory of relativity, based on the maximum speed of light in a vacuum, $e = mc^2$, set the standard for scientific and philosophical reflection in the twentieth century. Einstein's theory is based on the premise that nothing can exceed the speed of light, and it made the speed of light the yardstick of modern physics. Although light can be slowed as it travels through various media, nothing can exceed the maximum speed of light. When light beams refract through a raindrop or a prism, for example, the act of slowing the speed of the light creates colors, yielding a rainbow.

Light and the refraction of light has engaged the attention of thinkers such as Aristotle, Pliny, Leonardo, Descartes, Newton, Goethe, and Wittgenstein. Newton's *Opticks* of 1704 was the result of an investigation dating back to antiquity, to Arabic scientists, and to medieval authors such as Al-Hazen, and, later, Bacon, Kepler, and Huygens. Light has always been the source of new concepts in physics.[1]

In the early twentieth century the philosophical ramifications of the theory of relativity also inspired artistic innovations. Its influence is particularly evident in the work of Marcel Duchamp, arguably the most influential artist of the century.

More recently, in her ground-breaking work at Harvard, Lene Hau has slowed the speed of light to 0 miles per hour. No one yet knows the implications this discovery holds for the future of scientific research. What can be surmised, however, is that every aspect of culture, including the arts, will be affected by this development. It is this celebration of 'the new' that is most exciting about light. To study the history of advancement in science and scientific research, is to study the development of theories about light.

Just as 'all roads lead to Rome,' all advances in science, art and architecture lead to light. Relativity led to a new, relativistic set of developments in the arts and in architecture. Now that the speed of light can be controlled, a new world of artistic and cultural interpretations will follow. The architecture of the twenty-first century will incorporate this new milieu of scientific thought and revolution into itself. It is this on-going revolution in thinking that this book attempts to address and chronicle.

THE INSPIRATION OF COLOR AND LIGHT: GOTHIC ARCHITECTURE

Abbot Suger, the Abbot of the Church of St. Denis in the twelfth century, saw color

and light as the most important aspects of church design. Suger set about redesigning the abbey church of St. Denis as a reflection of his belief that light and color are the closest representations we have of spirit. When St. Denis was completed in 1144, the Gothic style was born from Suger's search for an architecture of light.

Light continues to be the most inspiring element of architecture, art, music, and life. That inspiration has altered in response to developments in the sciences, reflected in the arts and philosophy of each era.

What follows is a brief survey of contemporary culture, including video art, light art, and sculpture; as well as new developments in science, music and the theater arts. This brief survey attempts to convey the far-reaching effect that ideas concerning light have on contemporary culture. Following this survey, the second half of the book is dedicated to the influence of light on contemporary architectural practice.

VIDEO ART: FILM AND LIGHT

Film and photography are made possible by light. Both art forms originate from early experiments with light, specifically the development of the camera obscura ('dark chamber' into which light is admitted through a double-convex lens, forming an image of external objects) and the camera lucida ('light chamber' wherein the rays of light from an object are reflected by a prism to produce an image). The video installations of Bill Viola are immediate and primitive to the point of allowing viewers to re-enter the space of these original instruments of film.

Viola is widely recognized as a leading video artist on the international scene. His video installations—environments that envelop the viewer in image and sound—employ state-of-the-art technologies and are distinguished by their precision and direct simplicity.

Since 1972 Viola has used video to explore the phenomena of sense perception as an avenue to self-knowledge. His work focuses on universal human experiences: birth, death, and the unfolding of consciousness. It has roots in both Eastern and Western art as well as Islamic Sufism, Christian mysticism, and Zen Buddhism.

Viola has carved a niche as a unique artist working in a new medium. His work is deeply enmeshed in intersecting spiritual traditions, from ancient to contemporary. He has been instrumental in establishing video as a vital form of contemporary art, and has helped to expand its scope in terms of technology, content, and historical reach.

In Viola's installation *Chott el Djerid (A Portrait in Light and Heat)*, desert mirages are set against images of the bleak winter prairies of Illinois and Saskatchewan, Canada.[1] *Chott el Djerid* is the name of a vast, dry salt lake in the Tunisian Sahara Desert, where mirages often form in the midday sun. Here the intense desert heat manipulates, bends, and distorts light rays to such an extent that you actually see things that are not there. Trees and sand dunes float away from the ground, the edges of mountains and buildings ripple and vibrate, color and form blend into one shimmering dance.

Viola's video deals poetically with the phenomena of light reflection and refraction, recording naturally occurring light distortions. Image number ten (opposite below), cut from the video, shows forms in the desert landscape hovering in the sky.

There is a resemblance between these images and the works of the nineteenth-

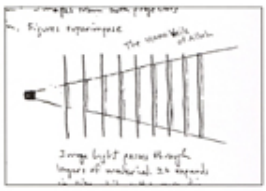
century Impressionist painters. Both attempt to put the viewer into direct contact with the phenomena of reflected and refracted light. They immerse viewers in the atmosphere of other places through the representation of light.

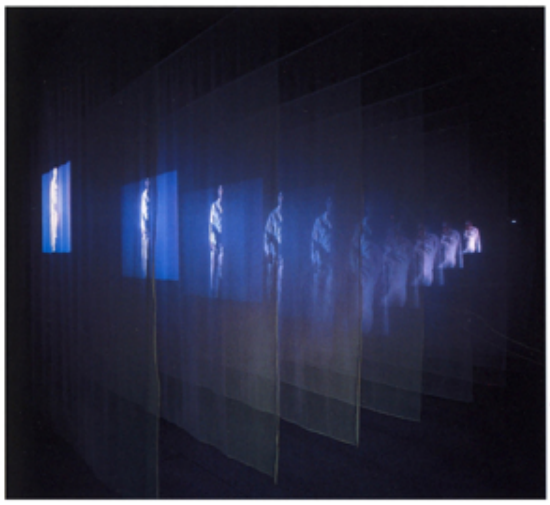
Viola's *The Veiling* uses beams of light projected toward one another from two directions to create an impression of images moving toward one another. The following text describing *The Veiling* was written by Viola for the Whitney catalog to describe his installation at the Whitney Museum in 1998:

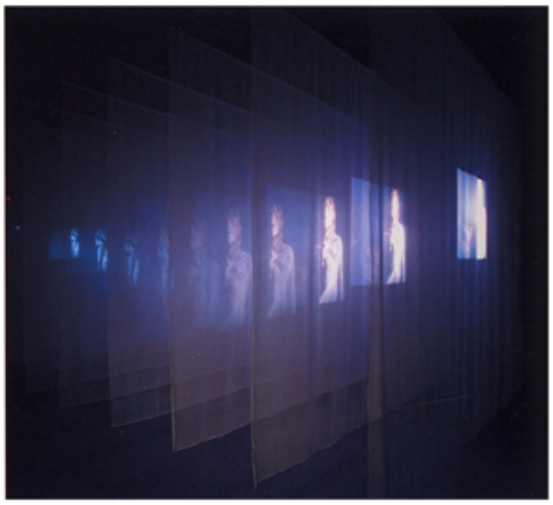
"Thin parallel layers of translucent cloth hang loosely across the center of a dark room. Two projectors at opposite ends of the space face each other and project images into the layers of material. The images show a man and a woman as they approach and move away from the camera, viewed in various nocturnal landscapes. They each appear on separate opposing video channels, and are seen gradually moving from dark areas of shadow into areas of bright light. The cloth material diffuses the light, and the images dissipate in intensity and focus as they penetrate further into the scrim layers, eventually intersecting each other as gossamer presences on the central veil. Recorded independently, the images of the man and the woman never coexist in the same video frame. It is only the light from their images that intermingles in the fabric of the hanging veils. The cone of light emerging from each projector is articulated in space by the layers of material, revealing its presence as a three-dimensional form that moves through and fills the empty space of the room with its translucent mass."[1]

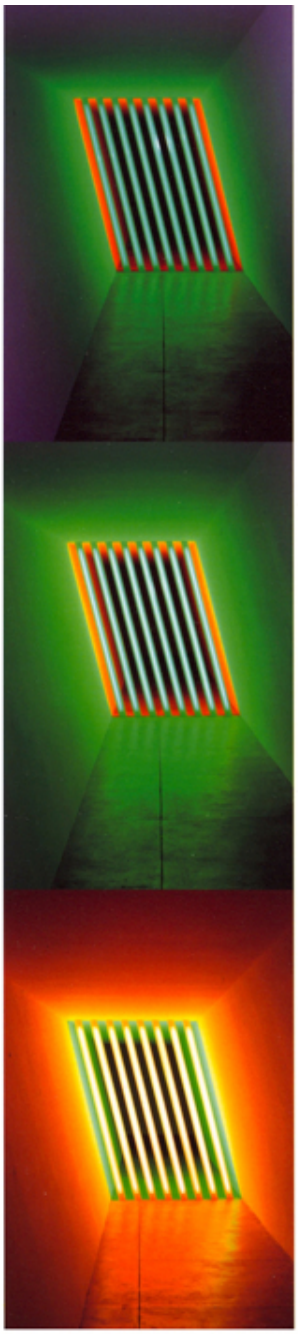
LIGHT ART: THE ART OF LIGHT

How we see is crucial to our perception of art. Beginning with the Renaissance invention of one-point perspective, and through the nineteenth-century fascination









with light revealed in Impressionist art, to the contemporary era and the proliferation of light art by artists such as James Turrell and Robert Irwin, light is not only the means of illuminating a subject, but becomes the subject itself.

Contemporary light art could be said to date from the 1960s when a number of southern California artists began using fiberglass, cast acrylic, polyester resin, and glass as media for their works. These new atmospheric works presented light as a medium of experience to viewers. Instead of looking at a work of art, the viewer is placed inside it so that the work becomes an experience.

These works blur the boundaries between painting, sculpture, and architecture, making color and light, and their dispersal in space the subject of the art. Particularly relevant to this use of light as a medium for art is the work of Dan Flavin. Born in New York City in 1933, Flavin had his first solo exhibition of assemblages and watercolors in 1961 at the Judson Gallery. The year also marked the beginning of Flavin's use of electric light as a medium for artistic expression. In 1963 Flavin began to work solely with commercially produced fluorescent bulbs with the completion of *the diagonal of personal ecstasy (the diagonal of May 25, 1963)*. For the rest of his career Flavin's medium was fluorescent light.

Flavin's art inverted the typical museum experience of moving from room to room to view pictures. Instead, his installations highlighted the spatial containers where they were displayed. 'The voids... became the means by which he reconceptualized sculpture and space, investing corners, baseboards...in short, every place but that traditionally reserved for the display of art, with a previously unacknowledged presence.'[4]

Richmond Hall is the result of a project commissioned by the Menil Collection in Houston, in 1996. Flavin had been discussing an installation of his work here since 1970.

Built in 1930, Richmond Hall has a simple rectangular shape with a storefront and an open interior reflecting its former life as a grocery store. The main part of the installation is in the large open interior space, 125 feet (38 metres) deep by 50 feet (15 metres) wide. An arrangement of 4-foot (1.2-metre) fixtures extends along the two longer walls. Mounted about 4 feet (1.2 metres) above the floor, running the length of the walls, filtered ultraviolet lights face into the room and separate vertical fluorescent lights. These are offset, the top bulbs facing the back wall of the room, the bottom row facing the front wall. The bulbs alternate in a sequence, of pink, yellow, green and blue.

The central, horizontal ultraviolet light blends the colored lights to form white light. A skylight in the center of the space allows daylight into the room, and gives visitors a tabula rasa, where they can check the coloration of Flavin's mixed light (white light) against daylight.

This piece works with fluorescent light to produce a very similar effect to the composer, Arvo Part's, musical composition, *Für Alina* (see page 15). Both *Richmond Hall* and *Für Alina* blend chromatic scales of light to produce a mixture, yielding white light.

Flavin was associated with other artists of the Minimalist school, including Carl Andre, Donald Judd, and Robert Morris. It was through his close friendship with Donald Judd that Flavin's most recent installation was planned and finally executed at the Chinati Foundation in Marfa, Texas in 2000. The installation consists of interior lighting with fluores-

cent lights of six barrack buildings at the Chinati Foundation, a former military base. The six buildings are planned in an alternating scheme. Two fixtures and tubes are always attached back to back, illuminating the space in two opposite directions. The first two buildings glow in pink and green, the following two in blue and yellow, and the last two bring all four colors together to make 'white light.'

Light is also the primary focus of the work of the artist Rei Naito. Her work relates ancient traditions of Japanese culture to new technologies. By constructing environments in a process reminiscent of an Ise Shrine, Naito creates the sensibility of the Ise Shrine, using modern technologies and natural light sources. Her work consists of installations that illuminate with light, almost invisible drawings titled namenlos/Licht, and performance/art installations.

Naito's work brings viewers into contact with a unique sense of space and time, and proportion and light. Much like Dan Flavin, Naito develops her installations as holistic environments. Light is a key aspect of each environment, creating the perimeter of the space and the mood of the piece.

One Place on the Earth is Naito's best-known work. In 1997 this piece represented Japan at the Venice Biennale. *One Place on the Earth*, like an Ise Shrine, has been reconstructed many times. The piece was originally shown at Sagacho Exhibit Space in Tokyo in 1991.

In *One Place on the Earth* space is created by a large white tent with a continuous perimeter of glowing candles. The project deals with the physical senses of touch, vision and perception.

The tent for *One Place on the Earth* is a space about perception, elucidation, and the act of seeing and understanding, through light. Naito's tent installations

have clearly defined perimeters, marked by a ring of candles that hold the edge of the space.

The contemporary light artist, Mary Temple, bases her work around light and perception. A particularly interesting aspect of Temple's work is that she studies light by never actually portraying real light. Instead she plays with the viewer's emotional and perceptual relationship to light by painting images of window reflections in windowless rooms.

Temple's work plays with and modifies aspects of environmental perception. Her window sculptures appear as light and shadows cast on a wall from a nearby window. The shadows may be from plant life surrounding the window, or just the geometry of the structure of the window frame. They are comprised of an image of light painted on the wall. The conceptual sculpture created by the viewer lasts for only that moment when she or he is convinced that what they are seeing is actually light and cast shadows.

Speaking about her work, Temple summarizes her relationship to light, art, and architectural space thus: "Imagine a windowless room in which there appears to be strong light raking the wall and pooling onto the floor. The rectangle of light seems to be coming from a nearby window, and as you turn to find the source, you understand the shape, size, and location of the (non-existent) window, as well as the time of day the light references. When painting these site-specific trompe l'oeil installations, I rely on the viewer to complete the architectural intervention by conceptualizing a window. In this work and other recent projects I'm interested in what informs the emotional stability of a site, how tenacious or fragile our memory of an environment is, and how I might affect conceptual modifications to physical places."

PHYSICS AND LIGHT: NEW BREAKTHROUGHS IN SCIENCE

Science and changes in scientific ideas have, through the centuries, been precursors of changing ideas in the arts. Today we are once again in the midst of a scientific revolution through the work of Lene Hau, the physicist who has succeeded in slowing the speed of light to 0 miles per hour.

On February 18, 1999, a paper reporting the results of her experiments on light was published on the cover of the leading scientific journal *Nature*. Hau, the leading author of the paper, with her colleague Steve Harris, and two of her Harvard students, reported the results of their experiment in which a beam of laser light was slowed to the astonishingly low speed of 38 miles (61 kilometres) per hour. By comparison, light in a vacuum travels at about 186,000 miles (299,338 kilometres) per second.

Hau's laboratory at the Rowland Institute for Science in Cambridge studies the interaction of lasers with a matter called Bose-Einstein condensate. By shining precisely tuned lasers on a condensate, or cloud, of ultra-cold sodium atoms, Hau and her team reduced the speed of a light beam to a pace slower than 38 miles (61 kilometres) per hour.

Initially, Hau's group succeeded in reducing the speed of light to 56 feet (17 meters) per second. Most recently, they have stopped a light pulse altogether, parked the pulse in a cold atom cloud, and then controllably revived it. Hau's work on ultra-slow light and atomic-wave guides for cold atoms has forged entirely new paths in optics and nonlinear optics.

This achievement, noted by newspapers, magazines and broadcasters around the world, heralds many new practical applications. These include the development of optical switches that