# LIGHT CELEBRATING PLACE,

# WEST TEXAS ROAD TRIP

A Dissertation

by

## JILL MULHOLLAND

Submitted to the Office of Graduate Studies of Texas A&M University in partial fulfillment of the requirements for the degree of

## DOCTOR OF PHILOSOPHY

May 2007

Major Subject: Architecture

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Approved by:

Chair of Committee, Committee Members,

Head of Department,

Mardelle Shepley Mary Saslow Tazim Jamal Mark Clayton

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May 2007

Major Subject: Architecture

## ABSTRACT

Light Celebrating Place, West Texas Road Trip. (May 2007) Jill Mulholland, B.A., Rutgers College; M.A. University of Oregon

Chair of Advisory Committee: Dr. Frances Downing

The dissertation explores the ability of light to embody and enhance the spirit of place in the Big Bend section of West Texas. A series of surveys and research investigated and then paired elements of light and place that were designed, and installed or simulated, in four experiential case studies. The case studies were evaluated by published authors of light and place and the dissertation committee and deemed mostly successful. Light installations can be embodied and enhance the spirit of place, the installations which were experienced "live" did this most effectively.

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### **1 INTRODUCTION**

Dear JT,

11/8/06

I am going to explain my dissertation in this Introduction in the form of a letter to you. I want to say it in my own voice, to a real person who cares, not to some nebulous public in the dry traditional form. Since I have been writing you all along this letter seems natural. I hope it will be personable, interesting, and accessible to you and anyone who wants to understand what I have been doing and why. One of my committee members wanted me to bury this part later in the document; she was worried that a letter would make the dissertation appear less "professional." I contend that I am proud of what I have accomplished and want to express it in a way that readers can get to know me and my work. I want them to be able to "get inside my head," as you have called my writing style; after all this is where the ideas came from in the first place. Just in case you or anyone else reading this is yearning for the more usual dissertation, simply skip the Introduction and start at Section 2. This Introduction is also the "space in between," my thoughts behind the work of the dissertation that link everything together. I realize now that the case studies often dealt with the "space in between" too. The road trip study is the space between and connects by making a trail between locations. The train/three cultures utilizes the space between the train cars for the projections, and the lighting of the wind turbines uses the darkness between the illuminated blades.

This dissertation follows the style and format of Leonardo.

I am lucky that PhDs in architecture are new and coming of age when different formats and methodologies are being explored, and that the experiential has a place. I am lucky that Christo and Jean–Claude, after 26 years of trying, finally got to install "The Gates" in Central Park in New York City. I am lucky that the newspapers quoted viewers and their varied understanding of the large-scale work. These quotes (and others) explain parts of my PhD that I have been predicting for years; proof of the far-reaching and positive effects of art. I am lucky that my committee members are open-minded about new ways to perform and write dissertations. I am lucky to have you to write to.

This letter, like the dissertation, is in many interwoven and overlapping layers of my thoughts. Not linear, the layers have no clear beginnings and ends, they swirl together. I have interspersed it with many images and quotes that present similar ideas hoping that a few will resonate within you. Here is an example. Both of the following quotes say similar things, but I find the second more accessible.

...one of the fundamental reasons for this continued absence is Cartesian dualism\_\_\_\_the epistemological tradition in Western thought that separates the mind\_\_\_as rational, thinking, immaterial, private mental substance, and the only essential part of the human being\_\_\_from the body\_\_\_as the irrational mechanical, material, or physical substance that merely provides the public, physical extension in the material world. This bifurcation of the person into mind and body has in turn led to a host of other dualisms: subjective verses objective, knowledge verses experience, reason verses feeling, theory verses practice, and verbal verses non verbal.<sup>1</sup>

But in the interim between the train and home, she walked and ran looking about her in a kind of glory, by the back way. Virgie never saw it differently, never doubted that all the opposites on earth were close together, love close to hate, living to dying, but of all of them hope and despair were the closest blood\_\_\_ unrecognizable from one another sometimes, making moments double back upon themselves, and in the doubling, double again, amending but never taking back.<sup>2</sup>

### 1.1 Journey

I think my dissertation is best described as a journey, both inward and outward, and it will tell you about me.

... the body of work that is experiential and educational in nature; they are passages to an awareness...an introspective and personal searching.<sup>3</sup>

I have had an adventure, explored new places, worked hard, learned a lot, and had (mostly) fun. Certainly where I have started and ended are important, but to me there were the surprises I discovered along the way, the side trips that somehow always led me back to some aspect of the dissertation itself but with another area I hadn't been thinking about better defined. I will tell you about these in the bonuses section at the end. This journey has been an exploration in layers that run together and swirl around each other, personal, abstract, biased, and incomplete. It is my life's work, and it continues, even as I write this.

I always think about this journey of the soul. The soul is the house we live in; the house we live in is living energy. It is a process of being made over again. Every morning when I get up I say to the cosmos, I want to be made over again. *I* want to grow. *I* want to change. *I* want to say *I* breathe matter and movement. The soul means to drink light, the universal intelligence is light and everything is in movement. Movement after all is what created perceptual reality and perceptual reality allows us to perceive through our feelings, thoughts and senses. Every time you say an English word or a Spanish or French or Tiwa word, or speak in any language, you are doing it without realizing that you are unfolding the cosmic soul. In doing so we become the bringers of light, we love to drink light and that means learning and growing in intelligence. We are going to get to God in spite of ourselves. I have been working with physicists in Albuquerque, New Mexico, along with some other Indians, talking about how the English language is very limited. Now the quantum physicists are looking to Native American languages because they seem to incorporate a lot of ideas that have to do with energy and vibration and light. In the Tiwa language we know that every idea has a twin. Science has difficulty with that. How could this light

be here and be there at the same time? However, if you have the premise that first of all we do not really exist, then it is perfectly natural, because when we do materialize in breath, matter and movement we are passing through time and space. Space is not empty. Space is full. Space is the up above and the down below; it is matter and sky energy. It is also centeredness and clarity and radiance and beauty. These are the components of space, it is all metaphor.<sup>4</sup>

#### 1.2 Beauty, Light, Celebration, Embodiment

You know JT, I see things all the time. I see little pieces of light that are silent, intriguing, and a sort of secret that only I see/know. I call these light vignettes; I have seen them for many years. Each one is different, fleeting, most never occur again. Sometimes they are small, metaphorically like one clear note in music, a bell. Sometimes I see a simple melody, a flute. If I am very lucky I get to see a light symphony. Every one is beautiful and I am grateful to be able to see them. That this beauty exists gives me hope in spite of this difficult life that we humans insist upon living. Hope because if I keep my eyes open I can find them and they always touch me. I feel them in my heart, an intimacy (embodiment), I feel less alone with them in a small celebration (light) of that moment in that spot (place).

But he wanted to leap up, to say to her, I have been sick and I found out then how lonely I am. Is it too late? My heart puts up a struggle inside me, you may have heard it, protesting against the emptiness... It should be full, he would rush on to tell her, thinking of his heart now as deep as a lake, it should be holding love like other hearts. It should be flooded with love. There would be a warm spring day... Come and stand in my heart, whoever you are, and a whole river would cover your feet, and rise higher and take your knees, and draw you down in whirlpools, and draw you down to itself, your whole body, your heart too.<sup>5</sup>

In the hundreds of side canyons and washes, on semi wild pieces of mainstream... fluid gravity still more or less makes its own decisions and follows the path of its own weight, taking with it worn-down pieces of the continent grain by grain. It is in these reaches that you are most likely to glimpse the river's fight for eternity. To witness that persistence is why many of us make our home there. For me the bond between self and place is not conscious \_\_no truth will arrive that way\_\_but entirely sensory. Instinct and intimacy bring the feast closer, the river celebrates things we forget how to celebrate: our own spirits, the eternity of all things.<sup>6</sup>

Once you told me that what I did was show others the ordinary in a different way, but these vignettes are not ordinary to me, although I see them regularly and in everyday places. The light vignettes can fall into five different categories; shadows, reflection, a combination of both, color, and glow. These are my own personal properties of light and why I find it beautiful. I think we count and categorize as another way to get to know/understand things better, again a different kind of intimacy. After I take in the vignettes' beauty, I always have to figure out how they are made. I have learned almost everything I know about light in this manner. I don't "get it" from sentences in a book, I have to see it or touch it to understand.

You know, I had a professor, not on my committee, follow me down two flights of stairs in her adamancy that I could not do a dissertation on light and beauty without the philosopher Kant. Kant, in his very male, ultra-rationalist mind, killed beauty and biased many for centuries. Even today I think we are afraid of beauty because it is foreign to our linear rational minds and you feel it. I find many are afraid to feel. I don't know why. Some say they feel beauty in their souls or hearts, and it can elicit involuntary tears, it is in us. But we don't have an organ called the soul and we can't quantify what we feel in our hearts. Whatever the sense, visual, sound etc. beauty is most strongly experienced "live" you have to be there, like the difference between a live concert and the CD. It is not about all the tasks we have to accomplish in the future. It is the present, right now. Beauty stops us and we forget about linear measured time, maybe for a second but that second can last hours and take us somewhere. I don't think there is

enough beauty in the world.

However uncertain we are about whether the absence of beauty from our own lives is a benefit or a deficit, once we see the subject from a distant perspective, it instantly becomes clear that the absence of beauty is a profound form of deprivation.<sup>7</sup>

We as a species are so divorced from deeper meaning, so detached from the mystical and the divine and the universal in our every day, instant-gratification lives, that it takes something like a powerful hallucinogen to show us just how meek, and limited, and far from merging with God we still very much are.<sup>8</sup>

The next quote is exactly what I am not talking about, I do not experience beauty

in a "deeply intellectual, connected to mathematics," way. This is not to say that it is a

"bad" way, it is just not my way.

The experience of wonder no less than that of the sublime makes up part of the aesthetics of rare experiences. Each depends on moments in which we find ourselves struck by the effects within nature whose power over us depends on their not being common or everyday...Finally, they are both experiences tied to the visual taken in a deeply intellectual way; they both lead us back to reflection on ourselves and on our human powers; and they both have deep connections to mathematics, as Kant showed in the case of what he called the mathematical sublime, and to whatever link there might be between mathematics and the most essential details of thinking itself.<sup>9</sup>

I "feel" it, as

...a sense of pure awareness, merging with ultimate reality, a transcendence of time and space, a feeling of sacredness or awe, a deeply felt positive mood like joy, peace, love...impossible to put into words.<sup>10</sup>

Ok JT, that's the first piece, light vignettes are celebrations of the beautiful and

there is an absence of beauty in the world. Now I want to show/explain to you what I

see.

### 1.3 Shadow

The other morning, running out the door, I saw the curved shadow of wire mesh projected on the front and the back of an oval-shaped plastic pitcher (Fig. 1). It made me slow down and stop for a moment. I saw the mesh and the pitcher, plain and ugly, become interesting, and, for a moment, beautiful.

For Kate Rosenberg, 9, a third grade student at Rodeph Sholom, a private school on the Upper West Side, the saffron colored gates dreamed up by the artist Christo and his wife Jean-Claude, have altered her vision of Central Park. 'Before I didn't really look at the park, she said, I didn't see how beautiful it is. These gates, and there are billions of them, make me feel l will not look at the park the same way again.<sup>11</sup>

I see the arc of the shadow of a metal spoke wheel on the cylindrical body of an old steam engine (Fig. 2), so graceful, stretching like a cat around that curve, and only for me to see. I am grateful.

It's like a gift, says New Yorker Stuart Bridgett. It's like someone came along and dressed the park up for you. Next to him Krissa, his wife, is equally impressed. I think they are beautiful, she says of the 16 foot high stands adorned with bright saffron panels. The simplicity is really cool. <sup>12</sup>

I see the shadow of a post turn the twined wire black in an old fence (Fig. 3). I see many lines of light because everything we build is in 90 and 180 degree angles. The lines, especially if they fall on a curved surface, come to life for me (Figs. 4-6). I like light through holes (Figs. 7 and 8), a camera obscura. This is the same as the sunlight through the spaces between the ramada, on the hammock strings (Fig. 9). We see examples of this every day in the spaces between tree leaf shadows on the ground, a mottled moving mixture of shadow and light. The next time you see one look closely; see how some of the leaf shadow edges blur? A scientist might say that all these are examples of light acting as both a particle and a wave, which is true but I would rather see the beauty of the shadow and feel it; the shade in the hot Texas summer is pleasurable. Sometimes I think it might be fun to see only in shadows, which give so much information, like the intricate cross bracing of a tower (Fig. 10). Isn't it odd that by looking at the ground I can tell the condition of the roof (Fig. 11)? The bumpy jump rope shadow (Fig. 12) reveals the bubbles in the roof sheathing. Shadows tell me secrets and I become aware of things I don't notice in sunlight; look at the line of the edge of the wheels (Fig. 13). The trio of the tree, roofline and wall, are united in the shadows that fall on the wall (Fig. 14). I notice that a flat wall has lots of texture (Fig. 15). All of these light vignettes make me feel warmth inside, make me smile.

The gates had dignity. They stood still, moving just a little, like the leafless tree. The trees didn't seem to mind their brief companions. Indeed, they tamed The Gates. Like this: Across a glade, rising to the clock tower by the Metropolitan Museum, the branches of the trees broke down 'the Gate's solid rectangles into the glimpsed, cracked shapes of the branches choosing. Many people thought the Gates were made for walking through. I thought they were made for standing and staring, turning, and staring again. Amid bleak February it was hard, there in the orange-tinged Park, not to feel, well, happy.<sup>13</sup>

I also have a category within a category called, "fat shadows." Fat shadows happen when the angle of the sun is very low in the sky. Fat shadows are a little ridiculous, like the puffed up chests of banty roosters, they seem all proud and prance-y, on display. Has that rebar ever been so bold (Fig. 16)? Is that an antelope? Has the metal cable seemed stronger (Fig. 17)? The rippled shadow makes that plain iron bar look like it is dancing (Fig. 18).

Overall, the event reminded me of a festive parade of flags, such as towns put on to mark important civic holidays. Or of a tall ships' day, or a kite festival, or

some newfangled kind of daytime fireworks display. Or, best of all, it reminded me of how nice it feels at Christmastime when lighted garlands stretch out across downtown streets.<sup>14</sup>

Sometimes I see chance occurrences of lines and shadows together that look like they were staged. I didn't place that snakeskin, shadow, and stick together, I just found them (Fig. 19), it was a wonderful joy of discovery, a surprise. Shadows and light are all about angle; our minds record all this information constantly, but unconsciously. This is the reason that most don't "see" light vignettes, but I have trained my eye. Shadows also affect color; look at the corrugated wall sections (Fig. 20), the same material, yet two different colors.

### 1.4 Reflection

Reflection is the opposite of shadow and somehow I find reflections even more fleeting. Maybe because I see reflections most often in the flash of sunlight on water, both ever-changing (Figs. 21 and 22). I call reflection glitter, the shimmer is especially enticing, tempting, and mesmerizing.

The (Native American) storyteller ...told Bates how a man uses chips of mica to capture a woman. He directs the sun's glare off the mica like a sharp needle of lightning. She runs to escape, loses herself in the bush for days, then follows the glint of mica to her man.<sup>15</sup>

Recently I was at a three-year-old's birthday party in charge of decorating the backyard. I had three mylar, four-foot-long, palm trees, you know the ones that are paper thin, and three dimensional like umbrellas? I hung them in the sun near surfaces they could reflect on. One was near the bottom of the slide. I watched the children stop and stare at the reflections many times. When do we lose the ability to see the magic in beauty?

Mirrors, of course, are the strongest example of reflection, especially when the surfaces are irregularly angled (Fig. 23). Did you wonder if there are two telephone poles instead of one? We have all kinds of metaphors for mirrors and reflections, remember in the fairy tales how looking in mirrors foretold the future? Mirror, mirror on the wall? Crystal balls are round magnifying mirrors of reflection. <sup>16</sup>Prehistorically, the Maya (and many others) used mirrors as a metaphor for portals to the underworld. <sup>17</sup>We find reflections enchanting and it didn't surprise me to find them used in many myths and stories as the gate to another world. For me reflections let me enter that place inside myself where it is quiet and non-verbal.

I have loved blue morpho butterfly wings forever, the color both purple and blue, one of my favorites. A scientist might tell you this is interference, that many things in the animal world use interference, feathers, and fish scales. <sup>18</sup> Oil spots on the road in the rain are also interference. I started noticing that the shades of colors are always exactly the same in all the different occurrences, and iridescent. There are (were?) a lot of blue morpho butterflies in Central and South America that were used in tourist gift trays, which I collected for awhile. I love the trays because the color changes depending upon the angle that you view it. The two different colors are opposites, complementary. See how the blue changes to orange (Figs, 24–26)? Some of the wings stay blue because they are aligned in a specific direction. Reflection is all about angle. I tell my students, angle rules in reflection. Angle rules in shadow too but it is easier to see in reflection. Angle rules in light.

10

Reflections, like shadows, give a lot of extra information. The reflection of the sun on the dead grass in Fig. 27 tells me the direction of the wind. The "electric sawdust" (Fig. 28) is small bits of reflective signage from the road trip case study that fell on the floor next to the band saw. The pieces catch the light differently because of the varying angles of the pile they fell upon. I think reflections, like shadows, are seen best with lots of contrast, i.e., surrounded by the darkness (its opposite), as illustrated by the sun coming in a small hole of a smushed, storage area of a truck (Fig. 29).

I notice reflections more often than shadows because they are brighter and catch my eye. A scientist might say this is because we are phototropic, meaning light seeking, and that our attraction to light is in our DNA. <sup>19</sup>It is like those strange looking insects that have sensor "eyes" on their heads that tell them where there is light. We have evolved so that instead of sensors, the light goes in through our eyes and down the optic nerve to glands where it controls the release of hormones affecting biological processes and mood. A scientist might tell you all about SAD, seasonal affective disorder, where people are depressed because they don't get enough light. This is affected by latitude; the higher the latitude, the sharper the angle, and the less light there is. Hence, the higher suicide rate in Sweden and Alaska. I think this could be why I am in Texas (located at 30 degrees latitude), lots of light and better moods. I am certainly less introspective than the 15 years I spent in dark, rainy Oregon (located at 45 degrees latitude). Think of a flashlight, aim it straight down and you get a small circle of bright light. Then angle its back end down towards the table, like the sun going through the seasons, there is less light as the circle enlarges and becomes stretched out to an ellipse that covers a larger

area. Since we have evolved to spend most of our time inside, I don't think we get enough light. I think this is part of the reason there are so many depressed people. I read in a magazine that giraffes in a zoo were having miscarriages and it turned out that the blast of Christmas lights were starting their reproductive cycles early. When the lights were blocked from the giraffe cages they stopped miscarrying. We are so affected by light, but it is processed unconsciously so we are not aware of it.

Reflections can be "ordinary," (Fig. 30) where an aluminum soda can project its label color onto the table. I see a lot of straight lines in reflections too. Sometimes low angle reflections light things up for just a few minutes at certain times of the year depending upon the angle and position of the sun in the sky. Fig. 31 depicts the underside of metal beams that blazed for two minutes. There is a strong aspect of time associated with light, light defines time for us. Fig. 32 is the orangey pink of the horizon at sunset on the plastic greenhouse wall. Fig. 33 shows the white stripe of the strong Texas sun with the more relaxing blue light next to it. In Fig. 34 the rainbow seems to go up under the door, but in reality it is reflected from the floor up onto the wall. The spaghetti reflections in Fig. 35 are from tinsel; it shook and shimmied for me as I walked. I loved that.

I see some of the best reflections from glass windows that throw patterns onto their neighboring buildings (Figs. 36 and 37). This is important because light needs a surface to reflect on; we don't see it in space. Picture a shaft of sunlight through the window in your living room. You see it because it ends on the floor and illuminates the dust. If there were no floor and no dust, we wouldn't see the light; it has nothing to stop upon or to catch it. This is a hard concept for my students to understand that light and shadow are three dimensional. Have you seen the fountain show at the Bellagio Hotel in Las Vegas? Exquisite, and we love how the illuminated water dances on a huge scale to the music because the light exists only where there is water. The magic is very precise, where there is no water there is nothing to catch the light, and no light falls "out of the lines," we love precision. The Bellagio hired a composer and choreographer to design the light show, I wonder how much better it might have been if a lighting designer had been part of the mix.

The greatest light symphony I have ever seen was in Chicago in May, it happens at the same time every year. Two buildings with different types of glass and window dimensions reflect across the street onto three different facades (Fig. 38). Don't the reflections (Fig. 39) look like Japanese characters? That day I decided the characters were a secret code that only I could decipher. No, I can't tell you what it said, it was a secret; I can tell you that I laughed though. I couldn't believe I was the only one who could see them, five stories tall and very bright. I was excited, happy. I wanted to tell others on the street, but they would have thought I was a nut. It is sad that we think that beauty is only the provenance of lunatics, why is that? Do only children have imaginations?

He did New Yorkers a great favor by getting us all outdoors and on our best behavior, Mr. Davis said, referring to the artist Christo, who with his wife, Jeanne-Claude, designed the project. The whole thing was like pop in the best sense – almost frivolous, but not quite. People on Sunday were walking around with these happy, idiot smiles, like we were all let out from some institution for lunch.<sup>20</sup>

*Mr.* Yust, an art professor at Colorado State University in Fort Collins, said he was first bitten by the Christo bug in 1983, when he signed on to work on Surrounded Islands in which 11 Florida islands were encircled by pink floating fabric, after hearing the artists speak at the university. Since then he has tried to see as many of the installations as he can. 'I thought about that project every day for the next two years, said Mr. Yust, who, like many of those who travel the country or world to see the team's work, is an artist himself, I thought he was a big nut at that time. And I still think he is a big nut. But I am totally supportive of what he and Jeanne-Claude do. I feel they are among the last of the true idealists on the planet.<sup>21</sup>

#### 1.5 Shadow and Reflection

In all the years I have looked for light vignettes, only recently have I discovered a new category, reflections that occur inside of shadows. It is too early to know if they are rare or that I have been blind, time will tell. See the shadow of the street lights outside the architecture college (Fig. 40)? There should be no silver reflection in the middle of that shadow. The street lights have a flared vase-shaped reflector that is the source of this reflection. I haven't quite figured this one out yet, but I will. In Fig. 41 you will see parallel lines of dim reflections running perpendicularly to the fence shadows. These reflections were being bounced from a mirrored building across the river. Fig. 42 shows the shadow of the mesh cage reflected in the concrete floor. All that is needed for reflection is flatness, a highly polished surface; the color of the material does not matter. The Maya had black obsidian mirrors. I can see myself in the body of my black car.

### **1.6 Glow**

She was holding the amber beads they used to give to her mother to play with. She looked at the lump of amber, and looked through it to its core. Nobody would ever know the difference between the radiance that was the surface and the radiance that was inside. They were the two worlds. There was no way at all to put a finger on the center of light. And if there were a mountain the cloud would not touch its heart when it traveled over, and if there were an island out in the sea, the waves on its shore would never come over the place in the middle of the island.<sup>22</sup>

Against the grays and reds and browns of the canyon walls the prickly pear flowers resonate with luminous clarity. Their color is made sharper by the desert's lucid, nearly transparent light. This is a place whose radiance renders its wildflowers utterly brilliant. Perhaps it is the synonymous quality of light and color that pierces the heart. Surrendering to it carries a person beyond the land's harsh extremes to acceptance, then relief.<sup>23</sup>

My favorite kind of light is glow, or radiance. A scientist might tell you that all light is reflected but I disagree, reflected means bounced off, glow passes through. Compare the glass in Figs. 43 and 44. In Fig. 43 the light is reflected, but it is not anywhere as compelling as the light seen glowing through the same pieces in Fig. 44. The yellow lines in Figure 45 have little glass spheres thrown into the yellow paint line while it was still wet. I can always tell when they put new lines on the road because I see small piles of clear glass marbles where they missed. The spheres magnify the light when viewed at exactly the right angle; they pop out at night with the light from car headlights. A scientist might tell you all about the geometry of spheres and how they are used extensively in the lenses of telescopes, microscopes, and cameras. Now, compare the reflected light in the glass beads in Fig. 46 with the same beads, glowing in Figures 47 and 48. They look very different, and they feel very different. I think that to get to that introspective feeling with light, it has to glow. I tell my students, to get to "God", (whatever your definition of "God" may be) its gotta glow. I think the combination of very low light levels (shadow/darkness) and glow elicits the deepest and strongest connections to our inner selves. The Catholic Church knew this when they built tall, dark churches with many stained glass windows. Glow makes me want to follow it inward to

another place and that place is in me. In one of my earliest memories I wanted to follow the glow of the red light of the record player into the music. It was at my eye level. I told my sister we could get to the violins that way, but she was uninterested. I think that may be why I have loved the color red my whole life. I love red. I find blue light compelling in a different way. Blue light is both relaxing and enticing; lately many architectural lighting designers have discovered and used blue light in their projects.

Everything about my swimming pool fascination may come down to this: blue. In the West there is so much blue you can fall into it headfirst, something I tried often as a child. Blue was a good place to go, a country unto itself, transcendent and calm and I would not have to talk to anyone. I spent hours thinking of ways to design camouflage, a little suit I could wear that would make me invisible when I stood against the vast, hallucinatory sky.<sup>24</sup>

A scientist might tell you that we relax around blue light because it has the shortest waves, and that red energizes us because the waves are longer. Of all the glow I have seen, I find ultraviolet light (UV) to be the strongest elicitor of emotion. Did you know there are lots of beautiful and subtle colors in UV, but we only use the brightest, the most "garish?" There are a group of UV fluorescent rock collectors that call themselves, "glow hounds." A scientist might tell you that UV fluorescence happens when an electron gets kicked out of orbit, and the color results from the shift. I find UV light strangely beautiful, exotic, and other worldly. Like when I see a horse-shoe crab or a manta ray, they feel like they are leftovers from an earlier time, they feel ancient. UV light feels like that to me too, it comes from a deep place, like a dream I cannot quite remember, yet it is familiar. It comes as no surprise to me that black light was popular in posters of the 1960s when as a culture we were open to new ideas. It is also used in the "other worlds" of dance floors and at raves. I would like to design a UV wedding. I bet

the lighting designer for Cirque de Soleil is going to design a show in UV. A scientist might tell you that many flowers and underwater inhabitants are UV. Birds, bees and other insects see ultraviolet colors in their distinctive, individual coloring; this is how they identify each other. Low level colored glow helps us go to another plane/place in our heads/hearts without the use of drugs or alcohol. I tell my students, "who needs drugs when you have color and light?" Color and light are the strongest elicitors of beauty.

#### 1.7 Color

... and what a reception: *Red jade cups, food well set on a blue jeweled table,* And I was drunk, and had no thought of returning And you would walk out with me to the western corner of the castle, *To the dynastic temple, with water about it, clear as blue jade* With boats floating, and the sound of mouth organs and drums With ripples like dragon scales, going grass-green on the water *Pleasure lasting, with courtesans, going and coming without hindrance,* With the willow flakes falling like snow, And the vermillioned girls getting drunk about sunset, And the water, a hundred feet deep, reflecting green eyebrows Eyebrows painted green are a fine sight in young moonlight, *Gracefully* painted\_ And the girls singing back at each other, Dancing in transparent brocade, And the wind lifting the song, interrupting it, Tossing it up under the clouds...<sup>25</sup>

Color, to me, is the daughter or son of light; without light there is no color.

Without light there is nothing. That is why we love flowers, great color that sometimes glows (Figs. 49-50). At night I think we are deeply drawn to color because we only see in black and white. A scientist might tell you that is because we use only our rods for night vision, rods see shadows and work best peripherally, that our color-reactive cones

don't work at night. I see more shooting stars out of the corner of my eye than straight on. Color, like light, is a combination of itself and the surface it is projected upon; notice how we mostly see the color in the white parts of Fig. 51?

The sky and rocks are reflected in the plastic water bottle (Fig. 52). The brightness of the Chihuahua desert tells me that beans aren't black in West Texas (Fig. 53). The grayness of an overcast day makes colors pulsate and glow instead of being washed out by the sun. There is a slow pulsation in the matte surface of rust and paint in Fig. 54. Rust reflects almost no light, like black velvet, it seems to just suck it in.

Ok JT, are you still with me? These light vignettes are another layer, and beautiful, which is the first layer. None of these layers can stand alone, they are all swirled together. I have shown you many of them to demonstrate the wide variety and that they happen everywhere, all the time. I am hoping that a few resonated within you and you found them beautiful and that you might like to see them too. I have talked about the properties of light as I have come to understand them. Light needs a surface to reflect on, this surface is the next layer, place.

### 1.8 Place

*My* works create a sense of place, where the landscape often becomes an integral part of the work. Both the architecture and the sculpture are site-specific. I read clues from the existing site, identifying a character or feature on which to build. What I introduce into the land does not try to dominate or overwhelm the existing landscape but instead tries to work with it, producing a new experience or framing a site.<sup>26</sup>

When is the last time you saw the stars? I mean really SAW them? Did you feel them in your heart? Did you gasp? Were you speechless? Did you find your face wet

with tears? Did you feel a connection to part of something larger? Did you feel peace? Relaxed? Was time suspended while you drank it in? I think you probably have seen the stars in this way but many people never have.

I remember seeing the stars this way twice, both in 1976 when I was nineteen. The first time was in a small town in the Alps, at a high altitude, where the Eiger's 13,000 foot peak was the backdrop. It was winter, there was no moon. It was very dark, clear, and cold. I went outside and the sky was golden with millions, no billions, of stars. There were so many stars, I could not see any spots where even one more could squeeze in. Previously, I had thought that stars were sort of singular, I never saw any stars in between the points of the Big Dipper. A scientist might tell you that cold air is clearer, high altitude has thinner air, and that observatories that house those huge telescopes are always located above 7000 feet. The second time I saw the stars I was in the desert in northeastern Nevada. Later I was to realize that the Burning Man Festival is held in the same area, at the end of August when there is no moon. It came as no surprise to me that the festival has the widest variety of light art anywhere. Back in Nevada in 1976 we arrived very late, slept on the desert floor, and I saw a different aspect of the stars. There were not anywhere near as many as my experience in the Alps, but they came down farther, like someone had pulled a star shade all the way down to the ground. I remember the white ground, the black sky, and the stars twinkling and bright, not gold this time but platinum. I was stunned by these experiences. Seeing the stars in those ways connected me to something that was not rational, incomprehensible, so large that it took my breath away in its grand majesty. At the same time, I was part of this majesty because I could

see it and I could feel the beauty of it inside of me. And for just a little while, even though I was still coming down from the angry teenage years, I found happiness in this. Star struck. The stars, big, outward, and expanding were also small, introspective, and in me. To me this is the essence of place, a difficult concept to try and put into words, but its essence is that you feel it. Place can be a physical location, a place in your heart, a memory, it can feel like coming home, or a connection with a vastness that is unfathomable. I forgot all about those star nights until this dissertation. I think it is important to remember/feel the vastness of the stars. Those stars were the best and the biggest light symphonies I have ever seen.

Ok JT, now we have the beauty of the light vignettes in shadow, reflection, color, and glow, interwoven with place. Neither place nor light can exist without the other, like the fountain at the Bellagio, no surface, no light. The surface is the place; the light is in/of the place. This combination can elicit strong feelings and emotions of connection. Are you still with me? I hope so.

## 1.9 Architectural Lighting as Place

So then, FINALLY, I realized that all my postcards from the World's Fairs and the history of lighting design research, including the contemporary (see Figs. 55–75) were examples of making a place in/with light. Both a physical outside place that took you to an inside place largely through light's beauty. The Vatican, civic celebrations, amusement parks, and casinos became beautiful "fairylands of light" (exterior), where abstract concepts got inside your head/heart. At the Vatican (Fig. 55) this was done with hundreds of candles, the concept was "God." In 1906-1907, electricity was heralded with the illumination of Niagara Falls (Fig. 56) the Hudson Fulton Celebration (Figs. 57-58) and the utility building in Buffalo, NY (Fig. 59). At amusement parks and casinos, (Figs. 60-61) the concept was "fun" and excitement. At Worlds Fairs, (Figs. 62-65) a rosy future through "Progress" was promised. The power of America (Figure 66) and the Third Reich (Figs. 67–69) was communicated through the lighting of the battlefield, the German Pavilion, the Nuremberg party rallies, and the streets of Berlin's reception for Mussolini. Fig. 70 demonstrates "hope" in the red, white and blue lights of the Empire State Building that were not turned off after the attack of September 11, 2001.<sup>27</sup> Behind the Empire State Building the towers of light at the site of 9-11 are memorials of "grief." Christo and Jean-Claude celebrated Central Park with over 7000 gates; sunlight illuminated the fabric and the project elicited park "appreciation" (Fig.71). Motoko Ishii used gigantic projections to celebrate history (Fig. 72) and colored water for an otherworldly fair ride in Fig. 73. Dan Flavin's works invoke introspection with subtle color mixing (Figs. 74-75). Everywhere I looked I found light able to express all these different, yet often opposite concepts and emotions. Light was the medium, and the language. The language that let us get inside, that let us feel in our heads and hearts and in this feeling became the transfer/connection of this emotion to whatever the concept the light was portraying. Got it? Light is the universal language, as both the Tewa elder and others have written.

So why couldn't I do the same thing? Why couldn't I make places in light and of place, and of light and in place? Large-scale light vignettes custom designed specifically

for that place, where the viewers, through the beauty of light could access their hearts to feel a connection to their surroundings? Like a mini version of the stars.

*Creation is an exchange of ideas, of stories, of emotions, a means to make each other laugh and cry and emotionally react.*<sup>28</sup>

...in these works I seek to create an intimate dialogue with the viewer, to allow a place of contemplation, sometimes an incorporation of history, always a reliance on time, memory, a passage or journey. A direct empathy exists between the artwork and the viewer. These works rely on a physical or empathic response rather than on a learned one from the viewer in order to be understood—or more accurately, felt.<sup>29</sup>

I reasoned that I had to base this work on somewhere new, so that I could "see" the place with fresh eyes and analyze it. The scale had to be large and outdoors, to closer approach the scale of the stars. It couldn't be little or just anywhere or subtle, it had to be big, but not arrogant.

I am humbled by the beauty of the natural world. I do not believe anything I can create can compare to the beauty of the natural world, but these works are a response to that beauty.<sup>30</sup>

At the time, I did not have many words for what I was trying to do. It was mostly intuitive, usually the words came afterwards. And then I visited West Texas for the first time. It was love at first sight, (site?). I fell immediately and hard, it was spectacularly beautiful, seemingly minimalist, it was open. I felt different emotions sometimes simultaneously; awe, beauty, fear, I had never spent time in that type of desert. I thought perhaps that was the journey, to get to know the desert as a special place and design/build these case studies around it, to understand why I felt these ways.

Back there in the scrublands beyond the river this lack of objects for the eye to focus on seemed like a deprivation of the spirit, and I spent my whole time longing for something to break the skyline, one of the slim dark cypresses of my

home country, or a chestnut tree with the sun pouring through it, making every big leaf transparent, a luminous green. Here the immensity, the emptiness feeds the spirit, and leaves it with no hunger for anything but more space, more light \_\_as if one has suddenly glimpsed the largeness, the emptiness of one's own soul, and come to terms with it, glorying at last in its open freedom.<sup>31</sup>

#### 1.10 West Texas as Place/Study Area

Driving through West Texas (Fig. 76), I experience a rich complexity of place and time. The 50 old road and 130 year old train tracks weave a rhythm around and through volcanic forms exponentially older. Wide and flat in the valleys, then steep and winding in the hills and canyons, the views and colors are everywhere, impressive and expansive. I feel time in the bowl-shaped curves of the mountain sides, a basin. I see ocean shells in road cuts at 3000 feet. There was once water in this desert. Interesting edges meet here; the Rocky Mountains (Fig. 77) and Chihuahua Desert blend highly diverse flora and fauna. Three cultures, Native American, Hispanic, and Anglo, are evident in the art and architecture. Surprisingly, there are a number of "biggest and best" in this remote locale. Bakersfield has the highest concentration and largest wind turbine farms in the world. Marfa boasts the biggest collection of minimalist art internationally. The most extensive Indian rock art cave paintings in North America are in Seminole Canyon. One of eight astrological observatories in the nation, the McDonald, is outside of Alpine, and there is one of the deepest natural springs in Balmorhea.

West Texas is part of the South West; it is that triangular "tail" piece of Texas tucked under New Mexico. This area is also called Big Bend because the Rio Grande changes direction and makes a, "big bend," the river is the US/Mexico border.

Many writers, artists, and scientists have found inspiration in the deserts of the South West. Did you know that Ruth Benedict, the anthropologist, was friends with Ed Sapir, the linguistics king? Did you know that they corresponded in poetry, often about the desert in images of light, embodiment, and place?

There will come beauty in a silver rain Out of the storm-hung heaven of my soul Let me remember seasons that have lain Heavy as this with darkness and the roll Of the on-coming thunder. And were yet, Distilled to showers crystal-cool and white Beyond the gift of sunshine; heedless, let The storm close cold upon me, and the bite Of sand be on my breasts, nor question why The silver fingers of the rain are wrought Out of a maddened tumult and a sky No man of all would willingly have sought.<sup>32</sup>

I send you this. Through the monotony Of mumbling melody, the established fall And rise of the slow, dreaming ritual, Through the dry glitter of the desert sea And sharpness of the mesa keep flowing Of your spirit, in many branching ways, Be running mirrors to the colored maze Not pool enchanted, nor a water slowing.

Hear on the wing; see in a flash, retreat! Beauty is brightest when the eye is fleet. And priests are singing softly on the sand And the four colored points and the Zenith stand; The desert crawls and leaps, the eagle flies. Put wax into your ears and close your eyes.<sup>33</sup>

Ellen Melloy writes about place, light, color and the desert.

Intoxication with color, sometimes subliminal, often fierce, may express itself as a profound attachment to landscape. It has been rightly said: Color is the first principle of Place.<sup>34</sup>

Here I was in Texas, remembering that I was conceived but not interested in Texas and instead was once crazy to go to Egypt or Persia or the Arabian deserts to live on a caravan and how such dreams, as forlorn as they now seemed, were fed by light. The geography or aridity is a prism for brightness, the eclectic partnerships of a fiercely articulated palette. Deserts share a kinship of color. You know you are home and the world is not so large.<sup>35</sup>

Of all the things that I wondered about on this island, I wondered the hardest about the paradoxical contrast and affinity of red rock desert and turquoise ocean, the seduction of certain geographies that feel like home not by story or blood but merely by their forms and colors. How our perceptions, as someone once said, are our only internal map of the world, how there are places that claim you and places that warn you away. How you can fall in love with the light. <sup>36</sup>

I made ten trips to West Texas between March of 2002 and June of 2006, each a

minimum of 1500 miles.

The true heart of a place does not come in a week's vacation. To know it well, as Mary Austin wrote, one must "wait its occasions" \_\_\_\_\_ follow full seasons and cycles, a retreating snow pack, a six year drought, a ponderosa pine eating up a porch.<sup>37</sup>

Three of the ten trips were with others, seven were alone.

I can absorb w/o distraction the bursting fullness of light and living things that give the inert sandstone a tangible pulse. In solitude you strip yourself bare, you rest your mind on what is essential and true.<sup>38</sup>

The project area became approximately 15,000 square miles, and quiet. It had a

sort of calming desolation.

The land appraiser is late, which allows me to wander in solitude for awhile longer, attending to echoes of vanished voices. This gently rolling front pasture was root plowed in 1960, clearing away impenetrable nopal and huisache thickets, and seeded with buffle grass. There's no traffic on the Mines Road at this hour, and I can discern the rattle-rattle of the guajillo bean pods and the furtive foraging of a ground squirrel. I lack the discipline to empty my mind: some lines of 'Exile's Letter' by the eighth-century Chinese poet Li Po well up and inform the landscape. ...and all this comes to an end. And it is not again to be met with. ...and if you ask how I regret that parting: It is like the flowers falling at springs end Confused, whirled in a tangle. What is the use of talking, and there is no end of talking. There is no end of things in the heart <sup>39</sup>

I have felt this quiet a few times, often a mixture of respect and foreboding, like being out on the ocean in a storm, or the extreme cold of Alaska. Always it feels like a wild edge where I would die without my "equipment."

The beauty, the sheer physical beauty, is something that has imprinted itself upon me. But it is a skin over something far more ferocious. I sense a cold, I sense a vulnerability. I feel myself as something hot and bloody. My body, if it were harmed, the flesh would bleed. So if I find the little bit of warmth I have, I need to protect it. The idea of protection, of care, seems particularly momentous here.<sup>40</sup>

The project boundaries become (Fig. 78) west of the Pecos River, south of

Interstate 10, north of the Rio Grande, and east of the northerly line from Presidio on the

Mexican border through Marfa and up to Balmorhea. Sometimes I go outside of the

lines; to the cave paintings at Seminole Canyon State Park, to Bakersfield, to the hot

springs at Ruidosa, to the historic towns of Valentine and Van Horn.

# 1.11 Process

The trips at first were a series of road surveys, where I searched for the individual locations for the case studies. I also had to determine the designs of the installations, choose the types of light, the materials, and the forms. Most of this was an unconscious process that happened intuitively while surveying by car and on foot, and reading all about the Big Bend area. Maya Lin describes working in the same fashion.

For most of the works, I make an initial visit to a site, put it somewhere in the back of my mind, then return to my studio and start researching the project. I never know what I am looking for at this point and I never try to focus too

directly or self-consciously on the search for an idea for the artwork. The research, in fact, is more about my curiosity about a new subject. Perhaps this is because of my academic background, or perhaps I just miss school. In any case each work allows me to learn about a new subject.<sup>41</sup>

When making these works, I spend much time researching the site—not just the physical aspects of the site but the cultural context as well: who will use the site, the history of the place, the nature of the people that live there. I spend the first few months researching a multitude of facts, history, and materials, not knowing if anything I am studying will be of use to me in the artwork. I try not to find the form too soon. Instead, I try to think about it as an idea without a shape.<sup>42</sup>

The challenge, for me, is not technical but emotional: the attempt to capture the essence of the idea. ... I found it was impossible to predict or model or visualize its final shape until we actually built it; the piece literally changed, becoming too stiff with every increase in scale. I finally realized that I would not understand it or be able to predict if the form would work until I built it at its actual scale. After months of analyzing the form of the water wave --- how it begins and ends—I just had to go out into the field and shape it.<sup>43</sup>

One of my evaluators expected detailed drawings made ahead of time, measured with lighting angles, etc. Another told me to do scale models of one of the sites and the piece after I had installed it full scale in BBNP. My process did not work this way, it was an exercise of letting the ideas/forms come to me as I got to know the place, as West Texas and I became more intimate. Luc Lafortune expresses this quite well. He is the lighting designer for the Cirque de Soleil shows, and in my opinion the best theatrical lighting designer of this time. Lafortune was the keynote speaker at the Light+Building show in Germany earlier this year (2006); his topic was inspiration.

Inspiration is something that arouses an emotion, a reaction of sorts. This isn't the same thing as a purpose or a plan or even a stroke of genius\_\_\_ but very specifically, it's a moment when emotion wells up... that moment when things click and fall into place, a catalyst, a moment of revelation. Inspiration is the one thing that gets you thinking. It is not something to be found and discussed strictly at the onset of the creative process and then put aside but rather, it is something which carries you through the whole creative process by occurring again and again.<sup>44</sup>

For me the best idea I can come up with for finding inspiration is to simply open myself to it and make room in my life for it to find me. It's like looking for love: if you go after it, it keeps disappearing. But when you least expect it, when you are busy just living, that's when it shows up.<sup>45</sup>

Inspiration starts with a state of mind, a state of being. It's not something you can capture, but it can capture you, if you let it, if you put yourself in a place to receive it, or rather, for it to receive you. It is intangible. It is like the parting of the Red Sea, or the break in the clouds. You can't make it happen, but you can be ready for it when it comes to you, and be willing to take the risks that attract it to you.  $^{46}$ 

...a process where there is room for the unexpected, where mistakes and failure are embraced rather than avoided, it's probably not going to be easy.<sup>47</sup>

Ok JT, I am still talking about the process of the PhD, mine. The process of

letting the intuitive happen while submerging myself in these places and the writings

about them. We have Luc Lafortune's inspiration and opening yourself to it. But how do

you do that? How do you open yourself to inspiration?

### 1.12 Rhythm

As you may remember, I had a series of design methodology classes. In the first class the professor talked about translations and transformations. Yawn, I thought, couldn't he have used varied and more interesting words? Then he drew squares and arrows on the board. Ho hum, I thought, squares are so very boring. But then I started to notice a rhythm, and though the word was never used I heard a rhythm in "translation, translation, (leading to) transformation." Meaning, to me, that there had to be repetition before you could break free to a new idea. I heard a drum, and then several, a cacophony. But every so often they fell into this pattern/rhythm, sort of spiraled inward

to a new place, and sounded "right." Have you ever heard frogs or crickets do that? It starts out as a deafening mess, but it falls into a pattern/melody/rhythm for a little while, and I relax into it, hearing rhythm sooths me. At times the machines used to do this in the yogurt factory where I worked. I would start to move my arms, head, and butt to the rhythmic sounds of the cups falling and steel turning. Sometimes Donna (also from NJ) would dance too and everyone would laugh, production would be disrupted, we would get a break. In trouble, I replied that I couldn't help it; that the rhythm was "in me." The breaks were short though, the rhythm never fell into place for too long. Rhythm in sound can be magical too, especially when we perceive a recognizable pattern, you feel it inside. It is like the stars, just for a moment time changes, you can lose yourself and feel a connection.

So then I started thinking about rhythm, how it takes over almost like a trance, a kind of hypnotism. Chanting, singing, sports, dancing, driving, going fast, and sex all start with rhythm. Well why not creativity? Weaving has a hypnotic rhythm to it, while your hands and feet move the loom rattles in time. And I think about Penelope weaving while Odysseus was gone. Now I know that the 20 years passed for her because she was hypnotized by the rhythm of the loom the entire time. I start wondering if creativity starts with a rhythm. I think it does. I think routine can be rhythm.

Everyone has routines. What works for one person may not work for someone else. Routines can be comforting. They may be our jobs. They define our limits and we try to make something constructive of them. Twyla Tharp wakes up every day at 5:30 and takes a cab to the gym. Chopin played Bach. Beethoven strolled around Vienna with a sketchpad first thing in the morning. Giorgio Morandi spent decades painting the same dusty bunch of small bottles, bowls and biscuit tins.Chuck Close paints and draws and makes prints of nearly identical dots or marks, which, depending on how they are arranged, turn into different faces. Having a routine, knowing what to do, he has said, "gives me a sense of freedom and keeps me from going crazy. I'ts calming. He calls his method Zen, like raking gravel in a monastery.<sup>48</sup>

Out of routine comes inspiration. That's the idea anyway. To grasp what's exceptional, you first have to know what's routine. I once spent several months watching American realist painter Philip Pearlstein paint a picture of two nudes. He has followed the same routine for years. Desiree Alvarez, who is also an artist, said that the value of watching someone else's studio routine was, 'in terms of discipline, day to dayness and commitment to work even when it isn't going well.<sup>49</sup>

I began to notice that I always have to sort and impose order, and patterns, before I can create. This sorting is also a rhythm. For this introduction I, "sorted/patterned" 300+ pictures on 10 boards for a week before I could start to write. When I worked with UV paint I first had to mix and sort all the color possibilities. My house always has to be clean (in order) before I can begin any big work binge. I used to think that this was a form of procrastination, now I think it is part of my own personal rhythm.

During the methodology classes I often heard, "if you get stuck in a design, change the scale." To me this meant look at it a different way. In West Texas, this meant driving or walking around and looking at things from all different views and perspectives. I walked all over the site of the Chimneys in Big Bend National Park (BBNP) in all seasons and times of the day in order to arrive at the form(s) for the architecture of colored light case study. When I got stuck I climbed up a neighboring mountain, and the Chimneys became smaller, that's when I saw the Loch Ness Monster that I will tell you about later. I "changed the scale" and discovered that walking is a rhythm for me. At the same time, I got to know the area, came to "feel" it, I began to understand it intimately. I established a routine to get out into the field and I would look for changes from the last visit in the cactus and plants on the trail. I walked all over Riverside Campus for a year before I determined the locations and forms of the eight road trip installations. In walking I would relax into the rhythm of movement. It was a way that I could "let inspiration find me," as Lafortune would say. Is inspiration beauty? Seeing the beauty? Opening yourself to see the beauty? Is beauty pattern? Isn't rhythm pattern too? The Navajo understood walking, rhythm, and beauty long ago; this is one of their chants, also a rhythm.

*My Interior feeling cold, may I walk* No longer sore, may I walk. Impervious to pain, may I walk. With lively feelings, may I walk. As it used to be long ago, may I walk. Happily, may I walk. Happily with abundant dark clouds, may I walk. Happily with abundant showers, may I walk. Happily with abundant plants, may I walk. Happily on a trail of pollen, may I walk. Happily may I walk. Being as it used to be long ago may I walk. May it be beautiful before me may I walk. May it be beautiful behind me may I walk. May it be beautiful below me may I walk. May it be beautiful above me may I walk. In beauty it is finished. <sup>50</sup>

Ok JT, are you still with me? Establish a rhythm, a routine, a ritual, something that you can do with your body where you don't have to think, so you relax into the rhythm and your subconscious can let the "inspiration" come to, or out of you. I think this rhythm is different for everyone, but I think there is always a rhythm. A friend of mine plays basketball, bounce bounce bounce goes the ball\_\_\_ rhythm. Another friend of mine knits, click click go the needles, the yarn goes up around down\_\_\_rhythm.

I think rhythm is a pattern and we make patterns to understand and in the understanding we relax. When we relax inspiration can find us, and our subconscious ideas surface. Patterns are an intimacy, a way to "know" (nonverbally) something better. Got it? There is only one more part called "Bonuses."

### 1.13 Bonuses

I had many bonuses during the work, often on trips. I went to the Lightning Field in New Mexico, to the Burning Man festival in the desert in Nevada, I worked with glass in Corning, New York. I found rock carvings and inscriptions (Figs. 79–80) during the solstice that relate to motifs in the mid west with a strong connection to the "Double Woman" myth. The story says Double Woman is crazy but produces beautiful things, which made me laugh. One of the academic advisors would tell the undergraduates that he was sending them to "the crazy lady upstairs." This meant that he was enrolling them in my lighting class. I hope to always make beautiful things. I stopped in a few locations on the Pecos River to look for the sources of the Mogollon style of Indian cave art. This style came down the river through New Mexico, hundreds of miles to Seminole Canyon State Park in Texas. Outside of Santa Fe there is an archaeological site also called Pecos. There I found that the last inhabitants of Pecos moved to the Picarus. I read that the adobe of Picarus has mica in it so at certain times of the day the facades shimmered in the perfect angle of reflected sunlight. I remember that the 1939 San Francisco World's Fair facades had mica in them for the same reason. I wonder if this was the source of the "Seven Cities of Cibola,' story, where the Spanish explored the Southwest endlessly looking for the cities of "gold" in the legend. I think now that the shimmer of the mica

would have looked like gold across the desert and I wonder if they saw Picaris and that is what started the legend. It was during this search that I found the Tewa elder in the quotes who talks language to scientists, the light drinker, bonus.

I got bonuses when I took journeys into materials. I built/tested irregularly shaped glass chunks, calcite, plexiglass, and dichroic glass. I worked with UV fluorescent paints, plexiglass, and rocks, As I spent more time exploring these materials they became more familiar, another intimacy that later informed aspects of the designs. I noticed that the tests always have a rhythm. I often started out not knowing why I was exploring, only that I had to, an intuitive process. The bonuses always eventually brought me back to some theme of this dissertation itself, with the added depth came clarity. Clarity is always a bonus. The bonuses were also "spaces in between" the layers of the dissertation, always pleasurable, and usually included surprise and discovery. I wondered if they were Lafortune's "inspiration," or just a way of being in the project where I could, "let inspiration find me."

Satish Kumar walked from Delhi to London to Washington DC. "In every place, I was there, I wasn't making progress to get somewhere but to be somewhere. It's about relishing the place where you are. Technological progress is always you-are-not-where-you are. That's why walking is so important—place is sensuous, so you feel the air and you hear things. The speed of technological progress destroys sensuality.<sup>51</sup>

The best bonus is in February of 2005 it is still very real, so I will write it in present tens. I am in Big Bend National Park (BBNP) at the Chimneys, the location of the case study called, "The Architecture of Colored Light." I am walking all over the site to become more familiar with it, to find the exact location of the installation. The Chimneys, a geologic dike, are shaped like the Loch Ness Monster swimming (Fig. 81). The first and tallest rock is the "head." Behind the "head" in a curved line stretching about one quarter of a mile are a series of rocks, the monster's "humps." There is even a long tail that swings back coming out of the "water." I am on a hump and far from the trail that leads to my car, another hours walk. I have established a rhythm (walking), and in my head I design a light entry sequence. I will place colored pieces of glass that would flash with sunlight. The flashes would happen as you are walking in, walking east, and approaching the Chimneys on the four mile trail from the road. This walk takes an hour and I envision a series of these reflections that will let visitors know something special is going on here; this, of course, would be The Architecture of Colored Light case study. The Chimneys, running north to south, are perfect for this during the first half of the day. This is when the sun, rising in the east, would illuminate the reflections on the "humps." I imagine different placements for special days, or light events in the year, solstices, etc., and I wonder if I could get any color in the reflections, how I would set it up and the details. It is very hot, close to 100 degrees, and on the floor of this flat desert it could be 10 degrees higher. All I know is that I have to be careful and very aware of my water consumption; sun stroke is real here and nasty. Low energy indicates I am not drinking enough water and I notice I am starting to feel lethargic. I sit in the shade of a rock to drink before my departure; it is too hot to stay out here any longer. I always enjoy sitting because I get to drink in the subtle desert colors and the views. There is a 360 degree geologic panorama of all differently shaped volcanic formations. The Loch Ness Monster has many friends here. I love to watch the colors change with the shadows and angle of the sun (Fig. 82–84). Then I notice a straight line on the top of high outcrop which I try to ignore, (Fig 85). Too hot to climb up there in the sun, I want it to disappear. I hope that I am having heat hallucinations. I look in other directions, but it doesn't go away. There should be no straight lines anywhere in these rocks. I surrender and find that the source of the straight line is the flat top of triangularly shaped rock with a white small crystals that glimmer, the crystal face angled to catch the sun and facing south (Fig. 86). I realize it is an example of the light entry sequence I have just designed in my head, that the rock will flash and make reflections over long distances; that the Native Americans who lived here used this rock to signal, to talk in flashes. I realize that the Indians here spoke in light, that they had a language of light and it all makes instant sense to me. I tell the park archaeologist who, after saying the Indians here only used signal fires, gives me the "you are a nut, don't bother me" look. I reply, "110 degrees, hmmm start a fire or flash a rock, your choice," and depart. While I am in the rhythm of reading/researching I find out the white crystal face is calcite. Calcite cleaves like mica in flat paper layers. I know that reflections only need a flat surface and this is one of the few rocks that will do this without polishing. I get some calcite and test it as you will see later. I remember all those Mayan temples I climbed to the top of when I was an archaeologist. I remember wondering why the tops were always above the jungle and suddenly I know that they signaled with light too. I realize that if signaling in light was happening here, a "backwater" between the Southwest and Mesoamerican cultures, then it was happening in the metropolises of the Maya and the Aztec. I start researching signaling and find that it happened in Chaco Canyon, an archaeological site in the four corners region of the Southwest. Chaco Canyon had small mounds that the person stood

on top to become taller and signal further. There were many of these mounds, but nothing was found that was used for the signaling itself. I find maps online where Native American signaling was tested long distance and mapped. <sup>52</sup>I start to research the Navajo, who arrived in the Southwest late, because I know they were excellent at assimilating successful aspects of other cultures into their own. I look at their language, where all the verbs are in the present tense. <sup>53</sup>I look at Indian sign language and the quote about embodiment in this Introduction. At the time I don't know why but I save all the quotes and poetry because they are beautiful. I find a book where the author, a photographer, talks about "avisadores," the Spanish word means adviser, announcer, and warnings. These are natives of Indian descent who talked across the desert canyons in mirror flashes during the first half of the 20<sup>th</sup> century. I know that this photographer had a well-developed eye, and that he was very sensitive to light because of his photography. I understand that this is why he would notice the flash of the mirrors where others wouldn't. I wondered if he saw light vignettes like me. He recounts many examples of the avisadores' ability to communicate very specific detail in the signaling conversations. He tells how Cortez could never surprise the native populations and how frustrated the armies were in the Southwest. Both knew there was a communication system, but couldn't figure out what it was or how it was accomplished.<sup>54</sup>

I contact Robert Malouf, the Director of the Center for Big Bend Studies and the prominent archaeologist of the area. Malouf meets me at the Chimneys, where he confirms that the signaling rock was human formed and tells me that I would have to find a lot more of them to "prove" it. I reply that I have no credibility as an archaeology and felt morally obligated to show him in case he sees others during his archaeological work all over the Big Bend area.

I become fascinated by the potential of this prehistoric communication system and marvel that present day fiber optic systems are also made up of flashes of light. I realize that mirrors used by the signalers were just an evolution in material. I think it is like buckets, first animal skins or woven, then wood, to metal, and now plastic. I speculate that the earliest versions would have had to have been rock. I remember the mirrors in the myths of the Maya, made of mica and obsidian. I remember that my favorite Mayan god, Tezcatlipoca, was called the god of "smoke and mirrors," depicted with an obsidian mirror for a foot. He was a twin of Quetzalcoatl, a duality, the dark side. I wonder if he is also the god of communication, if the smoke is for smoke signals, the mirror for mirror signaling. I research mirrors in Maya culture and read that the Milky Way star locations were used as the Maya "tree of life," in their religion and art. I remember my star light symphonies from 1976. I find bits and pieces about the Maya and mirrors by Linda Schele. I remember her as the "wonder girl" of Mesoamerican Archaeology and pivotal in cracking Mayan hieroglyphs. I read that she has died at a young age and I am sad. She wrote a few books with David Freidel, an archaeologist that I met during my work in Belize in the late 1970s. I emailed Freidel about talking in light and he responds.

The best clear evidence that Mesoamericans used mirrors for sun flashing are the Mexican style back mirrors worn in battle. The warrior would hurl his javelin with a spear thrower and twirl around at the same time to flash light into the eyes of the enemy as the rain of javelins showered down. I do think that Mesoamericans used them for signaling, but I have not found precise descriptions of this practice yet.<sup>55</sup>

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Talking in light, worship through light, dancing battles in light, it doesn't get too much better than this for me. I "get" that light is the universal language, that when we meet other species, light will be language with which we communicate. I realize that light has spoken to me for a long time. I wonder how many archaeologists, turned architectural lighting designers, turned light artists there are in the world who could have recognized that signal rock. I am deeply grateful. Quite a bonus wouldn't you say JT?

So there it is, the "in betweens" of my journey of a dissertation. Do you understand now why I had to write it in this way? If I didn't I would have lost you fairly early on. I hope you found it interesting and enjoyable. I hope that it gave you an understanding of the all interwoven layers. I hope that you felt a few of the quotes and pictures and that they provided delight. I know that you understand about beauty and I hope in a small way it has added beauty to your world and that you might start seeing these light vignettes and feeling joy that I do.

Love,

Jill

# **2 PERTINENT RESEARCH**

#### 2.1 Literature Review

This literature review, like the dissertation, and like the subject investigated, is layered, embedded, and intertwined. It builds on a mixture of research from many fields on simultaneous levels. which is the overview; specific precedent studies follow. The overall design of the dissertation relies on the combined strengths of: the philosophy of embodiment; <sup>56</sup> this embodiment expressed architecturally; <sup>57</sup> the embodiment of light; <sup>58</sup>a combining of architectural research methods; <sup>59</sup> place making as embodiment; <sup>60</sup> geographers; <sup>61</sup> artists; <sup>62</sup> art critics; <sup>63</sup> Land, Installation, and Earth Art; <sup>64</sup> Process Art; <sup>65</sup> Light Art; <sup>66</sup> the sociology of visual culture where art and science inform/ perform each other; <sup>67</sup> and the importance of art that is beautiful and participatory. <sup>68</sup>

The case studies required extensive road, foot, water, and air surveys of West Texas with additional research into history; archaeology; geology; meteorology; tectonic movement; sun movement; topography; hydrology; natural history; past and present writings on the Big Bend area of West Texas; transportation; roadside art and architecture; glass, dichroic glass and plastic molding and forming; UV light filtering; train history, lines, shapes, sizes, and speeds; strobe light, flood light, and headlight, and laser technology; reflective signage technology; and wind turbine technology.

# 2.2 Philosophical Precedents

Lakoff and Johnson in *Philosophy of the Flesh* relate the "profoundly disquieting results of cognitive science first that, human reason is a form of animal reason, a reason

inextricably tied to our bodies and the peculiarities of our brains. Second, that these results tell us that our bodies, brains, and interactions with our environment provide our most unconscious basis for our everyday metaphysics; that is, our sense of what is real." <sup>69</sup> They go on to argue for an embodied mind, finding that reason "arises from the nature of our brains, bodies, and bodily experience," and is "mostly unconscious, metaphorical, imaginative, and emotionally engaged." That "our sense of real begins and depends on our bodies which enable us to perceive, move and manipulate." <sup>70</sup>

Forty-five years earlier, Susanne Langer, in "Feeling and Form," defined a "sphere of influence," or "ethnic domain," as "intersecting actions, continuous functional pattern, that is intangible and invisible." She finds that ethnic domain also has physical artifacts, that the combination of "artifacts" and the "intangible" constitute "ingredients in a culture, not its image." Langer adds that, "The architect creates its image: a physically present human environment that expresses the characteristic rhythmic functional patterns which constitute a culture." <sup>71</sup>

In *Philosophy in a New Key*, Langer defines "Significant Form" as the "essence of every art; it is what we mean by calling anything 'artistic.' …The mere notion of rabbits, grapes, or even boats at sunset, is not the 'idea' that inspires a painting. The artistic idea is always a 'deeper conception.' Artistic activity… is an expression of primitive dynamisms, of unconscious wishes, and uses objects or scenes represented to embody the secret fantasies of the artist."

... But the emotive content of the work is apt to be something much deeper than any intellectual experience, more essential, prerational, and vital, something of life rhythms we share with all growing, hungering, moving, and fearing creatures, the central facts of our belief, sentient existence. The imagination that responds to music (music an example of art) is personal and associative and logical, tinged with affect, tinged with bodily rhythm, tinged with dream, but concerned with a wealth of formulations for its wealth of wordless knowledge, its whole knowledge of emotional and organic experience, of vital impulse, balance, conflict, the ways of living and dying and feeling.<sup>72</sup>

James Turrell, in *Lighting a Planet*, articulates the "thingness" of light,

Light is a powerful substance, we have a primal connection to it. But for something so powerful, situations for its felt presence are fragile. I form it as much as the material allows. I like to work with it so you can feel it physically, so you feel the presence of light inhabiting a space. I like the quality of feeling that is felt not only with the eyes. My desire is to set up a situation to which I take you and let you see. It becomes your experience. I am doing that at the Roden Crater. It's not taking from Nature as much as placing you in contact with it. ...light is the material I create my art with. In contrast to other materials, light has no object, no image, and no focus. You cannot form light like clay or carve it away like wood. Yet I am interested in the "thingness" of light, the materiality which we normally don't think about. Light is not ephemeral; it is something. My work is on the relationship we have with light. You can feel the light with your body, when your eyes open, your feeling goes out of your eye like a torch.<sup>73</sup>

Where Lakoff and Johnson define the "big picture" of embodied realism, what it is, what it does, and that you feel it, Langer implies the concept of embodied realism on architectural and cultural levels. Langer's "intersecting actions, functional patterns," and the architect's, "physically present human environment," are the "mostly unconscious, metaphorical, imaginative, and emotionally engaged" bodily experiences defined by Lakoff and Johnson. Turrell takes it one step closer to this work by defining light as a medium that is felt. The feeling of the "thingness of light" is its embodiment.

Together, Lakoff and Johnson, Langer, and Turrell offer a more complete definition of "the articulation of feeling, an expression of the intangible, a sign of sentience," or embodiment, from the philosophic overview and as it relates to my work. They use similar words to express embodiment, such as "profoundly disquieting, animal reason, primal connection, primitive dynamisms, unconscious wishes, embody the secret fantasies, bodily rhythm, living and dying and feeling, feel it physically, felt not only with the eyes, you can feel the light with your body." We experience a work of art through our senses, deeply and unconsciously, we feel it in our bodies, it is translated by this embodiment, and we understand it in a new way.

This inquiry could not exist philosophically without the concept of embodied realism. Indeed it is an inundation of embodied realism. The "magic," of light happens when it is felt, it is unconscious; embodied. The survey for the study area had to be explored physically, to know places I had to walk through them, and when I found the right location, it felt right; it was embodied. Place is physical, or a memory, it elicits felt emotions, it is unconscious; embodied. Light installations, based on place, are seen, experienced, felt; embodied. Light installations are designed, physically built, using specific materials and properties of light, manipulated until they feel right, and recorded to capture the magic of light in the enchantment of place; all embodied. The aim of this study is to explore the ability of light to elicit a new insight, to consciously feel light's embodiment as a connection to the place it is. Or as Turrell would say "You can feel the light with your body… My desire is to set up a situation to which I take you and let you see. It becomes your experience." <sup>74</sup>

This inquiry could also not exist without the repeated use of embodied realism as the avenue on which the ideas were conceived. The following paragraphs are my descriptions/observations during the initial surveys of the Big Bend section of West Texas. The **"bolded"** words are examples of the "inundation" of embodied realism in

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this work mentioned above. The words describe different types of the "articulation of feeling, an expression of the intangible, a sign of sentience," or embodiment, described by Langer, as well as demonstrating aspects of both Lakoff and Johnson and Turrell.

In West Texas I wake up, I feel **alive**, my **sense of time** changes, **transcendent**, I leave the world behind. I feel **clarity**, the air is **dry and clear**, the light is **crisp**, the sky a **deeper blue**. It is very **windy**, in motion, **ever changing**. The views, hazy, blue, and **expansive**, are filled with extraordinary **geologic forms** that make me **go outward** to take them in. While contemplating this expansiveness, I am also **introspective**, the **scale** of the landscape **fluctuating** with my consciousness, it **connects** me to my surroundings and **I feel part of them**, I am part of them.

In Big Bend many edges **intersect**, the edges highlight the differences, the edges show the **contrasts**. Foothills, mesas, and peaks indicate the **beginning** of the Rocky Mountains, not readily recognizable covered by the carpet of the Chihuahua Desert. Where the mountainsides curve I **see a great basin**, and I know there was water here **millions of years ago**; oceans of water. The Mexican border, another edge, is delineated by the Rio Grande River, on its way from Colorado to the Gulf of Mexico. Undeveloped and remote, I **sense nature**, I see great **cultural variety**, and evidence of three civilizations, Indian, Hispanic and Anglo. The road and train tracks **weave visual rhythms** around and through volcanic **colors and textures**, straight and flat in the valleys, steep and winding in the hills. The train tracks **connect** the three cultures **through time**, the Indians assimilated into Mexican culture hundreds of years ago. There are many anomalies in this remote region. The largest wind turbine farms in the world are located throughout the Fort Stockton and Bakersfield areas. Huge in size, the blades move at the same **speed**, but out of **synchronization**, the **motion is mesmerizing**. One of the few mercury mines in the country has become the **ghost town** of Terlingua. Donald Judd constructed the largest minimalist art compound internationally, here in Marfa. This includes the work of Dan Flavin, the first light artist. In the bright desert sun, the colors of Flavin's fluorescent tubes are **subtle**, not easy to "feel." In Seminole Canyon, outside of Del Rio are spectacular Indian Rock Art paintings where 12-foot-high shamans **seem to fly** off the canyon walls.

The Chihuahua Desert of West Texas is the brightest place that I have ever been The car and then walking surveys became the vehicles for me to "know" (embody) both the light of Big Bend, and the essences or spirit of the place Big Bend. It is the light and these "essences" that make Big Bend special. Later surveys also become the vehicles to "know" (recognize/embody) the location of each case study.

## 2.3 Place Precedents

Intellectuals, architects, landscape architects, geographers, artist, and art critics have identified the philosophical, physical, and emotional aspects of place. Susanne Langer defines place as a "basic abstraction of architecture, a sphere of influence," that can be, "located geographically (or not), a semblance of intersecting actions, continuous functional pattern, that is intangible and invisible." <sup>75</sup> Frances Downing makes categories of the "intangible and invisible," identifying place intertwined with memory and

emotion, with strong connections to design. <sup>76</sup>J.B. Jackson finds that landscape "tells us there was another way of measuring time that the present is..., contemporary with the primeval." <sup>77</sup>Andrew Light and Jonathan Smith suggest that, "our sense of self, home, nation, community, and history is tied into our sense of place." <sup>78</sup>Andy Goldsworthy, unable to "separate place from work, atmosphere, and feeling," is interested in, "the binding of time in materials and place that reveals the stone in a flower and the flower in a stone." <sup>79</sup> Lucy Lippard finds, "place is longitudinal and latitudinal, temporal and spatial, a layered location replete with human histories and memories." <sup>80</sup>Donald Kuspit draws parallels between "place and aesthetic pleasure." He finds that both fill the human need for "relatedness, rootedness, transcendence, and a sense of identity." <sup>81</sup>

Place is all of these, a basic abstraction, intersecting actions, intangible and invisible, memory, landscapes, a sense of self, a community, home, the binding of time, a flower, a stone, temporal, spatial, provides aesthetic pleasure and a sense of identity.

I see and feel light in vignettes; hypnotizing on lakes it shimmers and flashes in diamonds, mysterious in the reflections of sunlit windows that move, morph, and vanish. I see it in snake-y water lines on tree limb undersides near ponds, mesmerizing in shadows of navy and purple that project through fog and foliage three dimensionally, I feel it, empty, on the black water of a river at night, where wisps of crescent moonlight come and go so quickly.

The vignettes are pieces of light caused by specific attributes of individual places. Light and place exist contemporaneously; they cannot be split apart and examined separately. Without the lake there are no shimmering diamonds, without

sunshine no reflections are cast from the glass windows. Without light we see no places, we see nothing, and without place, there is no surface for light to reflect upon.

The case studies in this dissertation are a premeditated version of the light vignettes that I see. The case studies are designed in light and of place in order to elicit a sense of self, community, identity, and/or memory. Some of them will provide a sense of history, aesthetic pleasure, rootedness, and relatedness. All of these words are another way of saying, "making a connection between the participant and the landscape surrounding them." Not everyone will feel these different embodiments, but, like "the Gates" designed by Christo and Jeanne-Claude in Central Park, "If one opened one's mind just a crack, it was hard not to be touched by them and lifted." <sup>82</sup>

#### 2.4 Expeditions

I found two place precedent studies with strong parallels to this work, a composer and group of artists went to Antarctica and the Arctic, specifically to produce music/art based on the environment.

In 1997, the British Antarctic Survey commissioned Sir Peter Maxwell Davies to compose a symphony based on the Antarctic, a sequel to Vaughn Williams' Sinfonia Antarctica written in 1953. Davies wrote the symphony after spending a month at a science station in Antarctica; it was performed in 2001 at the Royal Festival Hall in London by the Philharmonia Orchestra. Davies kept a journal before he started composing that reflected his ideas, observations, and feelings about Antarctica. In these writings I got the impression that Davies found the climate alienating. This impression was reinforced by listening to the Antarctic Symphony. <sup>83</sup>

Between 2003 and 2005, three expeditions, called the Cape Farewell Project, were made to Spitsbergen, an island located well above the Arctic Circle. The expeditions united 40 scientists, artists, educators and a film crew, and was funded by the Oceanography Centre and NESTA (National Endowment of Science, Technology and Art). Cape Farewell was conceived as a union of art and science, a premise that together art and science could deliver the message of climate change, global warming, and pollution to the public. It was felt that the (exclusively), "scientific message was being ignored." <sup>84</sup> The artworks were to "provide a human scale," for the message of global warming, and to make it accessible to the public. The artist's days were,

...spent immersed in the physical nature of this Arctic world; testing the sea and the cold, casting ice, examining objects eroded by weather, and dyes made of glacial mud. They came to know this place and it formed their art works. This Arctic world was changing, human behavior was changing it, and this reality was embedded in (the artists) Dan and Heather's work.<sup>85</sup>

The resulting artworks were exhibited at the Tate Modern, the Oxford Library, and parts of it are on tour throughout the United Kingdom school system. A documentary film was also produced. <sup>86</sup>

Instead of the cold climates of the Arctic, this dissertation was a series of 10 "expeditions" to the Chihuahua desert of Big Bend, where I too came to "know this place" and it formed (my) art works, (case studies).

## 2.5 Architectural Lighting Precedents

Human beings are phototropic or light seeking. Especially in color, light elicits strong emotion, unconscious and embodied it attracts, transports, and enlivens.

<sup>87</sup>Through time, architecture has provided many examples of light's suggestive and

transformative powers. Culturally, we use light to celebrate events, both mundane and moving; birthday cakes have candles, the fourth of July has fireworks, Christmas is awash in strings of color, the millennium was marked with large-scale displays of color and light with fireworks, and white columns of light shooting to the heavens memorialize the World Trade Center.

Celebratory light is usually colored, and we find it very beautiful. Henry Plummer defines this as "the strange rejuvenating beauty of radiant things." <sup>88</sup> Light abstract and mysterious, is all around us at all times and we are biologically drawn to it. Yet we have difficulty defining or articulating the types or characteristics of it. The Impressionists painted color and bright light, we find them universally irresistible. Light, in the form of color, is an extremely powerful elicitor of emotion; but processed unconsciously we hardly notice it.

In addition to the marking of events and time, historically, the richest and most powerful cultural institutions have always utilized our attraction to the color and light as a way to introduce new ideas. Just as in celebration, the idea was usually offered in the ambience of escape from the mundane. Often the object was huge in scale and rendered in color, which aided in drawing people outside of themselves and creating a sense of awe, while letting them know the "idea," was much larger than they were.

The earliest example of light and architecture used in celebration were the Egyptian pyramids. The Egyptians worshipped the sun, All seven pyramids, covered with highly polished stone, reflected sunlight at all times of the day and seasons of the year. In the New World, prehistorically, the religious structures in the Olmec, Mayan, and Aztec religions also introduced the light of the sun and stars in building orientations, iconography, sculpture, and art.<sup>89</sup>

The Chinese invented fireworks before the 10<sup>th</sup> century, which have been used to mark celebrations ever since. <sup>90</sup>The Catholic Church also incorporated sunlight to reinforce religious ritual. Clerestory windows, placed above and in front of altars, worked like a spotlight in the theater to feature gold adorned altars, and the priests. Stained glass windows exhibited color and light that invited introspection, prayer, and a closeness to "God." The Vatican is pictured adorned with hundreds of candles on the exterior in 1885 (Fig. 55). <sup>91</sup>

The "Sun King" Louie XIV filled his palace with many images, paintings and statues of Apollo, the Sun God. The Hall of Mirrors in Versailles was 250 feet long and a glittering display of light and reflections during the day, at night the mirrors reflected hundreds of candles burning in multitudes of crystal chandeliers. Louie also appeared in a coat with 14 million livres of diamonds sewn onto it, an astounding sum of money in the 17<sup>th</sup> century. These diamonds would have flashed and sparked as he walked, dazzling everyone and reinforcing his power; no one else could afford anything like it. In 1668, Louie XVI held a party to celebrate the victory of France in the war against Spain. Called "The Pleasures of the Enchanted Isle," he "transformed the park into a fairyland with illuminated transparencies" for 600 guests. <sup>92</sup> The Hall of Mirrors, his diamond-studded coat, and "illuminated transparencies," were all light features that reinforced the power and riches of the king of light, the Sun King.

The theater in plays, and later movies, is another example of the use of light to control mood and emotion, and it is still the best place to learn lighting as three dimensional art. Most of the award winning lighting designers today come from theatrical backgrounds. Theaters are boxes with no light at all except those hidden up in the ceiling by the lighting designer and arranged on specific angles, intensities, and colors. The walls are painted black so there is little reflection. The theatrical lighting designer, in conjunction with the actors and sets, creates the mood of the production with light that is embodied by the audience in the form of emotion. Historically, we go to the theater to take a break from our everyday lives it is another escape and would not happen without highly controlled forms of light.

The golden age of World's Fairs coincided with the advent of electricity and mass production. All three reinforced the others; electricity allowed the Fairs to be open at night, increasing the number of people who could attend. The fairgrounds were the showcases for electric lighting that created "wonderlands," where the public "dazzled by the lights," was introduced to consumerism. World's Fairs were attended by millions, cost staggering amounts of money to put on, and almost never turned a profit. The exhibitions were generously funded by the corporations that sold technology in the form of new products. The fairgrounds became fairylands of mystery and delight, magical environments intentionally designed to make the public forget about its troubles and everyday life. The advent of mass production needed consumers. World's Fairs were the live, "spectacular" environments achieved at night with the use of architecturally applied electric lights. <sup>93</sup>

At first, in the early World's Fairs, amusement parks, and casinos, light was applied to the exterior by hundreds and thousands in lines of low wattage-light bulbs (Figs. 60-61). Walter D'Arcy Ryan, the head of General Electric's electrical engineering division, began to experiment with artistic applications of the, then new, technology of large search lights. The postcard in Fig. 56 depicts his traffic-stopping, bridgeoverloading, lighting display of Niagara Falls in 1906. Next, he arranged the searchlights in a fan shape and called it the "rainbow scintillator," seen in Fig. 57 and in the background of the postcard in Fig. 58. In 1915 the people of San Francisco presented Ryan with the first-ever award for lighting design for the illumination of the Panama Pacific International Exposition (PPIE). Using theatrical lighting techniques on an unheard of scale, Ryan turned the fairgrounds into a series of stage sets where different moods were established according to the themes of the architecture and courts of the fair. Ryan hid the light sources on the roofs, in the trees, and had the architecture customized to accommodate the fixtures. "Hiding" the light source gave a sense of mystery as walls, fountains, and domes were illuminated "magically" with no glare. Fig. 62 is an overview of the nighttime illumination of the 1915 PPIE; the rainbow scintillator is the largest fanshaped object in color to the left. The scintillator consisted of 48-36 inch diameter searchlights that were manned by marines who changed the colors and angles of the lights in routines set to music, and at times, mortars and fireworks. The searchlights were based in the water and served as the light "backdrop" for the fair. The light from the scintillator was reflected from the steam made by a locomotive anchored at its base, also

in the marina, exclusively for this purpose. The locomotive can be seen in the lower right hand side of Fig. 63.

The 400' tall Tower of Jewels (Figs. 62 and 64) was the architectural centerpiece of the fair, and consequently, Ryan made it the brightest. Part of this effect was achieved by adorning the Tower with 102,000 lead-cut crystals from Austria, in five colors. Lead crystal has the highest incidence of refraction of all glass and Ryan had the "jewels" cut on specific angles to accentuate this. The "jewels," illuminated by the searchlights on the roofs, caused the Tower to flash and shimmer in the night and fog and the fair became known as "Jewel City." Ryan made a magical place in light where fairgoers were promised and became part of a rosy future through the "Progress" represented by the light at the fair. Ryan was also the first architectural lighting designer. He applied red, white, and blue light indirectly to the upper façade of the Buffalo Electricity Building in Fig. 59, and came out of retirement to light the 1934 Century of Progress World's Fair in Chicago (Fig 65), his last work. <sup>94</sup>

The searchlights that Ryan perfected for the 1915 World's Fair were originally intended for Navy boats and later used in land battles. Fig. 66 is the "Wonderful Night War Photo," showing the American attack of the German line. Adolph Hitler, through his architect Albert Speer, understood and used light and shadow to represent his rising strength during the Nuremberg Rallies that brought him to power in the early 1930s (Fig 67). The lighting of the Third Reich Pavilion at the 1936 Paris World's Fair (Fig 68) is ominous and frightening. Hitler/Speer dressed the streets of Berlin by illuminating hundreds of columns topped with the swastika bearing the eagle of the Third Reich for a visit by Mussolini (Fig. 69). Hitler made places of power and might with light, all examples of light used for evil purposes. <sup>95</sup>

Fig. 70 portrays the Empire State Building in red, white, and blue, and in the background to the right can be seen the twin towers of light at the World Trade Center. During the six months following 9-11, the lights in the Empire State Building were kept on, when usually they were turned off at midnight. Like some giant nightlight, the lights reassured New York of the strength of their country.

In Fig. 72, Motoko Ishii, a Japanese pioneer in the use and application of light during the early 1970s, illuminates a mountainside with projections of words that honored the sacredness of the shrine located there. The huge scale of the work is evident by the people visible at the bottom of the picture. Ishii also lit the Osaka World's Fair in 1970. Fig. 73 shows one of the rides designed in light and water. <sup>96</sup>

Through time, lighting designers utilized light in all its various forms, the sun, fireworks, mirrored reflections, diamonds, the theater's "black box," military searchlights, etc., in conjunction with architecture (place) to introduce abstract concepts both good and evil in "otherworldly" atmospheres. The light and lighting served as both the medium for the concepts and the atmosphere it which it was received.

## 2.6 Art Precedents

The background and precedent studies for this dissertation were complete before starting fieldwork in West Texas in 2004. In 2005, the Modern Art Museum in Fort Worth exhibited "Dan Flavin: A Retrospective." Also in 2005, Christo and Jeanne-Claude installed "The Gates" in Central Park in New York City. I read about "The Gates" and went to see the "Retrospective." If the Gates had existed when I did the initial precedent research, the dissertation would have been articulated much more clearly and sooner. Many of the quotes by people experiencing the Gates in were examples of the embodiment of art that I had been predicting. Flavin's work is about the beauty of color and light, and you feel it. Christo and Jeanne-Claude's "Gates" were a large-scale, outdoor work of art that connected the public with the place surrounding them and gave a sense of joy. This dissertation is a combination of the two, I designed light installations to elicit beauty (like Flavin's work), and installed them large-scale, outdoors, in a journey through which the participants become aware of and feel a connection to their surroundings (like Christo and Jeanne-Claude's Gates). The "pre-Flavin/Christo" research i.e. the research into earlier art types, pales in direct comparison to these two contemporary examples. It does serve as good background information, it is included later in this section.

### 2.6.1 Dan Flavin

"Dan Flavin: A Retrospective," was the first and only comprehensive exhibition of Flavin's 35-year career. It displayed 50 works that were arranged chronologically. The individual works were thoughtfully located in rooms that reinforced them. The short throw distances of the fluorescent tubes (how far the light extends from the tube, its source) was taken into consideration, and used effectively almost every time. If the tubes had been placed too far from the walls, there would have been no surface for the colored light to reflect upon, resulting in a great loss of effect. I had experienced other Flavin work, usually a maximum of two in the same place, and I had usually understood what he was trying to accomplish; the effects were beautiful, but very subtle. The Retrospective was very dark and the effects of the colored light very powerful, the beauty was perceived, felt, embodied. I started out in the middle of the exhibit and went to the end, then found the beginning; I didn't know it was arranged chronologically. By the 3<sup>rd</sup> or 4<sup>th</sup> work, I realized Flavin was demonstrating some "trick" that the light would do if I took my time to let it show itself to me. I spent 2 days and 12 hours at the exhibit; I sat, waited, felt, and observed, then I drew and noted his intention. I could not do this with the earlier works. This is exactly the same process I use for the light vignettes mentioned in the Introduction. Michael Auping, the curator of the museum commented, "Dan Flavin's light installations may be the closest thing we have to a contemporary sublime. The apparent simplicity of these industrial, fluorescent light fixtures belies their ability to swallow us in ethereal fields of color. Seeing Flavin's flowing luminosity traveling through Ando's generous corridors is something I've been looking forward to for a number of years." <sup>97</sup>

Some artists do not care to define or give meanings to their work. Flavin "asserted that his work, 'is what it is, it ain't nothing else.' It doesn't mean or represent anything. But it is, quite simply, beautiful." However neuroscience disagrees. <sup>98</sup>

The Flavin Retrospective traveled to London in January of this year, 2006.

Personally I would defy anyone not to feel something inexplicably affecting about the light sculptures created by the American minimalist Dan Flavin, currently the subject of a retrospective at Hayward Gallery, London. But neuroscientists are now producing more objective evidence that there's a great deal of point to Flavin's work—putting their fingers on how line, light, and colour act on the brain – to move, stimulate or sometimes poleax us.<sup>99</sup>

Dr. Mark Lythgoe, a neurophysicist, concluded that Flavin's work,

...taps into some basic brain responses that have their roots in our early evolution. We're programmed to react in a particular way to light, line and colour-- it goes back to our earliest survival instincts. Creatures with brains that had adapted to distinguish between form and illusion, light and shadow, movement and immobility, are most likely to be able to elude predators and find food. Natural selection means that the human race holds these deep rooted tools in common. And Flavin, an American who emerged in the New York art scene in the 1960's and died in 1996, taps into them.<sup>100</sup>

Dr. Lythgoe, from the Institute of Child Health at University College London,

described a Flavin work of red fluorescent tubes.

*Red is incredibly stimulating to the brain, which is why it can be so effectively used by artists. It goes back to our evolutionary past, when red indicated ripeness of fruit. Way back, we also became programmed to flee the colour red because it was used as a warning signal by some animals, for example apes and fish. That neurological remnant remains etched in our brains.*<sup>101</sup>

So when you can't help uttering a 'wow' in the face of an all embracing green created by Untitled (to you Heiner, with admiration and affection), 1973, Dr. Lythgoe reminds me that my response is a vestige of my ancestors sensitivity to green—they needed to be able to distinguish different shades of colour under tree canopies if they were to find food and avoid enemies.<sup>102</sup>

Dr. Lythgoe specializes in using brain scans to analyze which parts of the brain are active under which stimuli. With a team of scientists from University College London and King's College London, he was called in by Hayward Gallery to analyze Flavin's work in the context of the current knowledge about how the brain works. We now know from magnetic resonance imaging of the brain, for example, that light has a generalized effect throughout the brain \_\_as seasonal affective disorder (SAD) indicates, it affects our brain chemistry and our mood. But we process other visual information, such as line, colour and faces, in very specific areas of the brain. Brain scanning has now revealed that just one tiny part of the brain is responsible for colour.<sup>103</sup>

Studies have shown that the brain is very sensitive to line orientation as the angle of the line it sees changes. He stops me in front of one of Flavin's earliest, simplest creations\_ The Diagonal of May 5, 1963 (to Constantin Brancusi), 1963 a single yellowy-white illuminated tube at an angle of around 45 degrees to the floor. He says its positioning is far from random. I think Flavin would have played for hours with the length and angle to get a certain effect that felt right. I think he had something of a neurobiologist in him—though without putting electrodes into the brain to see which parts lit up. He, like all artists, knew something was happening instinctively. It taps into something that was, in evolutionary terms, very important to us. What Flavin did, says Dr. Lythgoe, was to tap into feelings and visual effects that we all share—and I think that's what art is. It's seemingly quite academic and quite hardcore, but you don't have to go much below the surface to see where it is really coming from.<sup>104</sup>

Figs. 74-75 are examples of Flavin's art, but as flat reproduced images they may

be interesting but are poor excuses for the power of these works felt, "live" in dark surroundings.

### 2.6.2 The Gates, Christo+ Jean Claude

Christo, and his wife Jeanne-Claude (C/JC), are the artists famous for extremely

large-scale, outdoor art works that often surround coast lines and architecture in fabric.

The installation of the Gates in Central Park in New York City, after 26 years of

rejections, cost \$21 million. This sum was raised by the artists themselves through the

sale of sketches, paintings and prints of the "Gates." The project was covered

extensively by the media, and well represented in the following quotes by people that

were experiencing them.

After 26 years of trying to convince New York to allow them to install the project, artists Christo and Jeanne-Claude, themselves New Yorkers, finally saw it happen. Hundreds of volunteers spent more than four hours unfurling saffron-colored panels from 7,532 gates on footpaths that snaked through 23 miles of the park.<sup>105</sup>

For 16 days, the masses flowed through and around Central Park's 843 acres to see 7,500 replicates of what some called "art" and others" totalitarianism" or "defacement." On the first weekend 800,000 people showed up, about 790,000 more than show up at the upscale art galleries downtown on Saturday. A friend arriving form California that Sunday reported that the airport was aflutter with out-of-towners flying in for The Gates. Ultimately millions came.<sup>106</sup>

*The unfurling might have gone more quickly, but the grinning volunteers -mostly groupies in gray parkas signed by the artists\_ were continually being stopped to have their pictures taken.*<sup>107</sup>

Usually in winter this part of the park is deserted, but "The Gates" are connecting us with the outside world," said one resident of Harlem.<sup>108</sup>

Nearby, Olfunmibi Awoshiley, a Nigerian who has lived in Harlem for two dozen years, said he liked seeing all the white people there to view the gates \_\_\_\_\_ even if they looked a little lost coming out of the subway in his neighborhood.<sup>109</sup>

It brings color to my gray state of mind in winter, burbled Weldon Lee. <sup>110</sup>

In addition to the spontaneous gatherings on the ground, there were multiple celebrations in high-floor apartments surrounding the park. At one Fifth Avenue party, many guests arrived in saffron-colored cashmere blazers and sweaters. The color scheme was even reflected in the food -- platters of smoked salmon and glass bowls filled with dried mangoes.<sup>111</sup>

Sandler said that part of the power of this exhibit was that it was temporary\_\_\_\_ "it will be pulled down in 16 days. Nobody would like it if it was still here in March." he said. <sup>112</sup>

Frankly, it was difficult to separate the boldness of the Gates from the beauty of Olmstead's original creation\_\_\_ and their power in showing the contours of the park<sup>113</sup>

I never realized all the different levels of this park, the hills, the steps, the way it undulates," said Anja Grafe-Friedrich, a 34-year-old Munich architect who had come to New York for three days to see the exhibit. She said that on her first day in New York, she thought the poles looked silly, like some lame project of a first-year architecture student. "But today the objects are alive, like a serpent occupying the space and with humans occupying the organism.<sup>114</sup>

It's very pleasant to walk through the park and watch as the sun bounces off the sparkling fabric or shines through it. The wind sometimes stirs up impressive nautical effects. A field of orange specks processing to the far horizon makes for some grand, intensely photogenic vistas. On the morning of the unfurling, the vibe was great as well, as families came out to take the air and take in the latest oddity on show in their town.<sup>115</sup>

For Robert Huebner, 'The Gates' elegantly blend in with the natural environment. "I wish I could see it from above," he says while on a stroll. I love the color and the way it brightens up the trees that have lost their foliage.<sup>116</sup>

Fig. 71 illustrates the translucency of the orange fabric in sunlight, undulating in wind. Figs. 87 and 88 depict "The Gates" seen from a distance and at different levels. Under a cloudy sky with the snow on the ground "The Gates" are a welcome contrast to the gray of the city. Fig. 89 shows a profile view of many gates blowing in the wind all at the same angle. In Fig. 90 the human scale of the gates are evident as the photographer was standing or walking under them.

#### 2.6.3 Andy Goldsworthy

For me looking, touching, material, place, and form, are all inseparable from the resulting work. Place is found by walking, direction determined by weather and season. I stop at a place or pick up a material because I feel that there is something to be discovered. Here is where I can learn. Some places I return to over and over again, going deeper\_\_ a relationship made in layers over a long time. Staying in one place makes me more aware of change. The best of my work...appears so obvious that it is incredible I didn't see it before. It was there all the time. ...when I work with a leaf, rock or stick it is not just the material in itself it is an opening into the process of life within and around it. Each work concentrates on an aspect of material and place.<sup>117</sup>

Andy Goldsworthy has not been classified into an art category as far as I can tell,

but he is contemporary and is included here. Goldsworthy (Figs. 91-94)

uses materials found on the site to construct his art works, which range from leaves to stones to ice to branches. His work connects people to place through the use of the actual material found on the site; the material is given a different context, by being positioned in different designs, beautifully and perfectly proportioned. For example, in Fig. 91 the three different shades of the leaves are appreciated because they are arranged in a noticeable way. This principle is the same for dissertation, except I am using works in light, sometimes in combination with the things found on site and sometimes as additions to the site.

### 2.6.4 Robert Smithson

Robert Smithson, in the *Spiral Jetty*, constructed a huge scaled work in the shape of a spiral with large rocks in the Great Salt Lake (Fig. 94). Built during a long drought, the work surfaces very infrequently after long periods of dryness. Smithson was part of the "Land or Earth Art" movement, art of the late 1960s and 1970s that advocated largescale works outdoors in nature. Previously art was viewed as something that only happened in museums.<sup>118</sup>

## 2.6.5 Walter De Maria

Walter DeMaria, also part of the Earth Art and Minimalist movements, constructed the *Lightning Field* outside of Albuquerque, New Mexico in 1977. I visited the site in the late spring of 2002. The work is not open to the public and reservations have to be made far ahead of time. The work is a rectangular array of 400, two-inch diameter, stainless steel poles on a one mile by one kilometer grid. Each pole is 220 feet apart and ranges from 15 to 23 feet tall with pointed ends. The poles all end at the same height in space and form a flat plane, where a giant book could rest as if on a table top. The poles are difficult to see between 9AM and 5 PM, but low angle sunlight in the morning and afternoon they glow like fat, whitish-yellow, neon tubes. <sup>119</sup>

# 2.6.6 Process Art Background and Precedents

Process Art took place in the late 1960s and early 1970s, and was a subcategory of the Conceptual Art Movement. Both Process Art and Conceptual Art

were reactions to the "stability and structure of Minimalism." Additionally, Process Art was a reaction to the, "abstraction of Conceptual Art, Process Art, (preceded and foreshadowed by Jackson Pollock's, 'motion based drippings'), and was exhibited in very few shows. The first by Lucy Lippard in 1966 called 'Eccentric Abstraction,' then in 1969 at the Whitney, a show called, 'Anti–Illusion: Procedures/Materials,' and at the Berne Kunsthalle, in Germany." <sup>120</sup>

In my opinion, Process Art took the perfection, cleanliness, and control out of Minimalism, and the, "in-your-head-ness," out of Conceptual Art. It did this by making huge messes of materials. Process Art also froze motion in some pieces. It was sloppy and sometimes specific procedures were evident in the final work. It was not about the always perfect and non cluttered of Minimalism. Process Art is defined by one author as "the means justify the end." The artist sets an event in motion and watches while it unfolds; thus, prioritizing the making of the art over the final product, and dismisses the priceless object d'art.<sup>121</sup> Process Art often also used "time, entropy, and anti-progress." as strong components, "producing work that reflected a reverence for the creative process rather than the enduring art object...<sup>122</sup> The process involved witnessing a series of prescribed events that the artist set in motion... the observation of this temporal process satisfied their goals often only in the photographs documenting it."<sup>123</sup> Another author finds Process Art countered Minimalism's "preconceived, factory made timelessness and structural clarity." That Process Art works are, "so bound up with actual time that they would assume form as well as meaning from conditions of impermanence and mutability." Process Art uses "organic substances..., plus time with

gravity, temperature and atmosphere, so that the materials are ever changing."<sup>124</sup> Finally, "the term 'process' when used in the context of art, is both precise and imprecise, 'an a-historical referent' as well as a 'historically specific periodizing marker.' Artists used 'process' as a natural phenomenon, the focus of their working method, and a style. Process visualized both the actual conduct of materials and behaviors of artists in their studios. Process also functioned as a point of intersection and transit between traditional painting and sculpture and the profusion of experimental practices in the late 1960s which collapsed form and content into a continuous state. Attention to process in art and its making marked a crucial moment when it was no longer possible to believe in the formalist and reductive theory of advanced art as autonomous and self referential because of the context dependent contingency of all objects to the conditions of their making." This "increasingly became a consciousness of how process informs practice at all levels from studio to institutions of art, enabling artists to show how formal aesthetics, social projects, and artist's goals formed inherent synthesis." <sup>125</sup> Next I will examine three Process artists, Eva Hesse, Nancy Graves, and Rebecca Horn in terms of Process Art with parallels to this dissertation.

Eva Hesse's art made "form grow out of process." She "kept the clear structure of Minimalism, but made it 'eccentric' with materials like latex that implied surrealism, as a way to make Minimalism more humanist." Many of the materials she worked with illustrated gravity; the ropes, fiberglass, latex, and rubberized cheesecloth, "droop, hang, sag, nod, and lean." <sup>126</sup>

Eva Hesse captured a moment in time through the materials she chose, her latex forms eventually succumbed to gravity. She freed latex and allowed it to imply its character, stretchy and irregular. Hesse's material was latex, my material is light. Latex is stretchy, gravity stretches it towards the ground. Light is reflective, refractive, in color, in shadow, glowing, and in that way the five installations are designed around at least one of these aspects of light. Hesse froze time in her works by freezing/implying motion. Hesse's work is, "tidy," the tidiness evident in how she "kept the clear structure of Minimalism," from quote above. My work is a lot about precision; precise angles of sunlight, reflection, refraction, absorption, intensity, and this precision is like the "kept the clear structure," of Hesse's. The precision will elicit magic. This is similar to her sagging latex; it wasn't an accident, there is selection and an order involved, a procedure, a process. Hesse wanted the sags to happen in a particular way, the same way I am very carefully choosing materials to catch light in specific ways.

Nancy Graves' Process Art made camels out of "wood, burlap, steel, polyurethane, skin, wax, and oil," and drew on her extensive study of "taxidermy, skeletons, bones, and fossils." This was in addition to a series of camouflage paintings that mapped currents of water and wind matched to aerial photos, with forays into anthropology, geography, and cartography. In 1969, she also made films. Graves says, "In order to make these pieces, I have to have some kind of specific relationship to them. I am interested now in the problem of levity, a lot of these pieces move independently. They have a fulcrum, and yet it appears they should weigh a great deal. Each part is free moving." <sup>127</sup> I have never seen Nancy Graves' work; however, we share the technique of reading a great volume of information in order to learn about the individual components that form the work. I use a massive amount of background information to learn about new techniques, materials, and place as part of the working process or procedure I use to get to the final forms. I have different kinds of maps for Big Bend, where I overlay the cultural, tectonic, topographic, and geological, and I work to understand the optical qualities of non symmetrical glass, cones of vision, the ultraviolet spectrum, lasers, the mechanical workings of wind turbines, etc.

Rebecca Horn creates environments that, "feature automated, electromagnetic, kinetic elements, incorporating different media, ideas, stories, texts, sketches, film, sculptures and installations, to suggest a psychological dimension." She wrote about an art work that she had installed in a medieval tower in Berlin, where in words she described and interweaved 500 years of the history with the present. She represented the past activities in the present utilizing sound and light and installed throughout the tower, experienced by climbing and crawling.<sup>128</sup>

Horn's work in the Berlin Tower is about time and place, in the present that involves a journey. The installation changes and we move around it. These are all aspects of what I propose to do. There is an other worldliness about her written piece I hope to elicit in the video. There is a "presence" of light in her work, I can see it in my mind, I know if I was there I would have felt it, embodied. She is one of the few Process artists that doesn't freeze time.

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The strongest parallels between my work and Process Art are a sense of time represented in motion, and letting materials express what they are. I am using light like paint or latex, it is the material I am forming, but to form it I have to catch it. In every installation I have set up different materials to catch different aspects of light that changes with the angles they are viewed from. Process Art often freezes time in materials, it implies time and motion. The five installations are not frozen, all are in motion, as the light is in motion, some stop to start again, some stop only at night, they are not implications.

Process Art is only sometimes about place (Horn, Smithson). If the installations can be set up in any gallery anywhere, the work is not about place. The five installations are about place and will be designed specifically for each location they occupy. Process Art seems to have taken place largely inside, where admission could be controlled and charged. The five installations will not charge admission and will not be controlled, there will be a sense of discovery in that you see something as you drive by and learn to look for/expect the next one. The five installations hope to attract anyone regardless of their art background, much like the roadside architecture of the 1930s–1950s that were fun surprises where people pulled over and explored. Process Art was about one artist, one piece, one stop, the five installations are all connected and part of a journey, some may find it a sort of art pilgrimage.

### 2.6.7 Art and Science Precedents

It is easy to think that art and science have nothing in common when in reality both are all about inquiry but from different perspectives. C.P. Snow's controversial book, "The Two Cultures and the Scientific Revolution," illustrates the "opposition" between art and science and argues they are similar. Although written in 1959, the perception of art and science as polar opposites still lingers today. Art and science utilize the same processes, inquiry, experimentation in controlled environments, creativity, abstraction, and intuition. Both can contribute the best, and sometimes the worst in cultural achievements. <sup>129</sup>Intertwined and embedded, art and science form a complex duality, where each performs the other. Science communicates with art through pictures, charts, and maps. Art incorporates technology in materials, tools, and construction Pattern-seeking humans, we simplify to understand; good/evil, male/female, art/science. Lately, we are beginning to realize the limitations of such divisiveness. We are beginning to realize that in combination opposites are no longer pieces, they become whole, stronger, richer, complex, and a more realistic view of ourselves and the culture in which we live. <sup>130</sup>

In, *How to Be Iconophilic in Art, Science, and Religion*, Latour makes the case that the combination of science, art, and religion, as the "mediators" of our culture, allow us to understand it from a complex overall view. And just as a Rembrandt is much more than the painting in front of our eyes, people, culture, and their works, we are not defined by just one of the three. <sup>131</sup>

Svetlana Alpers, in *The Studio, the Laboratory, and the Vexations of Art,* relates the similarities of the artist's studio and the scientist's laboratory. She shows a drawing from a three to four centuries ago that depicts the art studio as a giant camera obscura, where the walls formed the camera and the projection surface. Lately, it has been shown

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that all the great painters used this camera obscura method. Alpers finds that both the studio and the lab shut out other elements while freezing and concentrating on others. She gives an art example of trying to paint on a canvas with the light changing through the day and how the artist paints just one moment of it, and says that science does the same thing. <sup>132</sup>

In *On Astronomical Drawing* Simon Schaffer chronicles the early history of telescopes and the difficulty of recording the detail that no one had seen before. It took 20years to produce the drawings, largely because it was unseen, brand new, there was no context, and no one knew what they were looking at. It wasn't drawn and reproduced until standards were set up, a making of patterns to organize and order this new information. <sup>133</sup>

Marga Bijvoet, in 1997 wrote *Art as Inquiry, Towards New Collaborations Between Art, Science and Technology.* In it she gives many examples of artists using scientific inquiry in their art, although some artists, like James Turrell deny this. <sup>134</sup>

When the artist speaks about his work (the Roden Crater) in this manner, there appears to be somewhat of a dichotomy between the purely scientific research involved to obtain the desired results and the emphatic emphasis he places on the intuitive, even emotional, experiences in the approach. Certainly the work will not serve scientific purposes; the Roden Crater is not science, the artist insists. It is a work of art that is powered by the movement of the sun, moon, and starlight. Its function is to be an art work. However, his methods are to a large extent scientific and the artist could not have progressed without the scientific and technological research and assistance provided by astronomy, geology, topology, climatology, and so forth. The artist is advised on the astronomical implications by E.C. Krupp, Director of the Griffith Observatory in Los Angeles, and Richard Walker, an astronomer at the U.S. Naval Observatory in Flagstaff, Arizona. The projects involve a lot of cross-disciplinary research to obtain precise surveys of the geological data inside the crater, topological measures of the site, insight into the drainage systems of the crater, the seasonal biological processes and meteorological conditions of the area, astrophysical data concerning the position of the sun and the moon at such and such a day, and so forth. Yet the purpose of the scientific data gathered is completely geared toward research into the nature of perception of sky phenomena.<sup>135</sup>

Robert Irwin has called his approach one of response to the conditions of the selected or commissioned site. He always starts from the premise that a work can only come into being by asking questions—about the past and future of the site, its social, environmental, political, cultural ramifications. It is a constant inquiry, but no longer about the work's function as art, but as life, as a living environment. His plans are designed with the intent to enhance the spatial potential, including the aesthetic quality of the location, thereby, hopeful, creating a 'sense of awareness.' Irwin: The art of pure inquiry is an open interface between the pure subject\_all that is out there\_ and the pure potential of the individual perceiver – all that is in here... .the strength of this inquiry lies is in its single motive \_\_ the desire to know.

Irwin continues, Basically it's just to make you a little more aware than you were the day before of how beautiful the world is. It's not saying that I know what the world should look like. It's not that I'm reducing the world. Basically what artists do is to teach you how to exercise your own potential – they always have, that's the one thread that goes all the way through it." According to Bijvoet this continues, ...his research into perceptual experience which he started in the sixties.<sup>137</sup>

A Glow in the Dark, is a book that documents the scientific research in the

history of the field of bioluminescence. One of the scientists, Edmond Newton Harvey, spent 45 years searching for the "secret" of bioluminescence, and never found it. A few years later in 1961, Osamy Shimomur's discovery of green fluorescent protein turned out to be the "secret" that unlocked bioluminescence. I was surprised when the scientist described his breakthrough as "lucky," and the experiments as, "shots in the dark," full of trial and error. <sup>138</sup>

I will be using science and art throughout this dissertation, in the writing, designing, constructing, and analysis of the case studies. The process/procedure of this work is a constant evaluation of what Latour calls the "mediators." The design and

construction of the case studies will be choosing the mediators that will make the final work stronger, and recognizing the ones that will not. I am using the physical characteristics of light, the technologies utilized in the manufacturing of tools, and construction methods that all belong to science. I am incorporating aspects of place and light, to make them architecturally and artistically beautiful. Light is medium, everything is arranged around it. There is a bit of "religion" in the embodiment of the beauty of color and light. I hope that it is felt on a physical level. And this physicality leads viewers to be introspective, to begin to know themselves, and the place where they are, better. This is exactly like Irwin's, "a little more aware than you were the day before of how beautiful the world is." I think we do not have enough opportunities to do this in life.

### 2.6.8 The Sociology of Visual Culture

This section is a brief look at the sociology of visual culture and its relationship to Process Art. Art and science are not made in a vacuum; both reflect aspects of the culture, era, and person they were designed by.

Bruno Latour, in his 1986 book, *Visualization and Cognition*, followed by the 19 authors in Jones and Galison's 1998 book called *Picturing Science, Producing Art* (Latour is in this volume also), analyze, question, and examine the highly complex and visual roles of art, science, and power, currently and through history. All of this analysis shows that art and science defined what we saw and how we saw it. Latour also coined the terms the 'medium is the message', and 'art mediators,' in this book. <sup>139</sup>

Attention to process in art and its making marked a crucial moment when it was no longer possible to believe in the formalist and reductive theory of advanced art as autonomous and self referential because of the context dependent contingency of all objects to the conditions of their making. This increasingly became a consciousness of how process informs practice at all levels from studio to institutions of art, enabling artists to show how formal aesthetics, social projects, and artists goals formed inherent synthesis.<sup>140</sup>

This quote is the same as Latour's "medium is the message," indicating that all the messages added up give us the complex aspects of what the culture is. "The medium is the message" means that the combination of the components that the art is made of, and how it was constructed, are more reflective of the era and cultural ideas than the intent of the work. "Process forms practice," is another way of saying, on a more embedded level, that process is a mediator that forms the final piece.

I understand, "the medium is the message," better by examining how water was carried through time; starting with baskets and ceramics, buckets became wooden, then were constructed of metal, and now plastic. Each of these individually gives information about the technological advances of this culture and how it changed through time. So, instead of breaking the water vessels out of the cultural context and looking at them as an isolated frozen pieces, we examine them in terms of where they fit within the society they belonged to and how this was reflected in the object.

Art mediators, according to Latour, are,

The quality of the varnish, the type of market force, the names of all the buyers and sellers, the critical accounts evaluating the painting throughout history, the narrative of the theme and its successive transformations, the competition among painters, the slow intervention of taste, the laws and teaching of composition, ... together all these compose a Rembrandt. In art history the "more mediators the better...there is very little in the cultural studies of science at the level of details, heterogeneity, and the instability of the best social history of art. ...most of science studies can be defined as the anesthetization of science, we know how to *multiply the mediators, but we don't know how the mediators are embedded, telescoped, and unfolded into each other.*<sup>141</sup>

Mediators are all the things that make up a work of art, some of which you can see, most of which you can't, but in its complex entirety the sum of all the mediators defines/defined what the Rembrandt is/was. The scope varies from large to small. What animal hair was in the brush? Where do Rembrandts fit in the International Art Market?

Process Art valued the making of the piece over the final product, let's call this procedure the actions that go into art, things that you don't see. I think if we could list all the mediators that make up a Rembrandt that the procedure of the actual making of the painting would be on a line. Then we could list all the mediators that went into the procedure, some of these would be sketching, stretching, mixing, and painting. The procedure for making art, (the process of making art) is a mediator, actually many mediators, all linked together. These mediator "links" are different thicknesses and sizes, some very small.

In terms of this dissertation, it is important to think about the past visual experience of the audience that will view this work. That is why the installations are made of light, in color, often large, and hopefully, beautiful. Through the beauty of light and color the art will be accessible (to those that are open to it), and therefore participatory. Human beings are phototropic, we are light seeking, but this happens unconsciously. In the same way that computers, TV's and movies can hypnotize and mesmerize with color and light, so can these installations. I hope to seduce with the beauty of light and color. I hope that the audience feels something. That "something" is the beauty of light, I hope they understand and feel the "something" through beauty.

That's why light is the medium, and not paint, or other traditional forms, of art because of the strong unconscious draw we have to it.

Richard Serra did a work called "Tilted Arc," installed in and removed from New York City's Federal Plaza, in the 1980s; the public hated it. Serra blocked the plaza with the work and New Yorkers got mad enough to go to court and have it removed, because it cut the plaza in half, and the public gathered there. Serra blamed it on the general public's lack of art sophistication. <sup>142</sup> What arrogance. He plopped his art down there with no concern for anyone or anything but his glorified creation. The five installations are not conceived in this manner, but they will probably be read like this by some. The road trip and the architecture of colored light case studies being installed along hundreds of miles of highway and in a National Park are especially vulnerable. Perhaps a solution could be working with the locals and/or their children, so the public could participate in the designs of the individual pieces.

This next section provides a quick look at the history of visual culture. In 3 examples the topic of each article is specific, yet analysis provides information about the culture and times in which it was written.

In Lost Knowledge, Bodies of Ignorance, and the Poverty of Taxonomy as Illustrated by the Curious Fate of Flos Pavonis, an Abortifacien, Londa Schiebinger chronicles the plant flos pavonis. She explains the plant's discovery and use, the cultural positions of women, slaves, powerful men in botany, scientific classification systems, and economic issues. Ostensibly about a plant, it represents the complex context of the culture in which it was named, discovered, and lost. This article is a poster child for Bruno Latour's "the medium is the message," the plant carries messages about the cultures it was part of.

Katherine Park, in *Impressed Images: Reproducing Wonder*, relates the story of Margarita, a blind visionary who died in 1320, in whose heart three carved stones in shapes of Mary, Jesus, and Joseph were found. In the Middle Ages perception was thought to happen by impression, like minting coins or sealing wax. The human body received impressions through the senses, and women, with their, "soft bodies," were especially prone to this. Women were believed to give birth to deformed fetuses because they viewed "monkeys or other grotesque things" while they were pregnant. So the stones found in Margarita were, "evidence of her great impressionability making her visions authentic and confirming her holy status." <sup>143</sup>

Park tells us there were/are other ways of viewing the world. There is more than one way to see, perceive, and understand, not just our own. We understand the example of the carved stones in Margarita's heart because today we don't believe in "wonders," we don't believe perception leaves physical impressions. Today we know someone put Mary, Jesus, and Joseph in her heart or made up the story. This article makes me wonder what parts of our current belief system, discounted in the future, I am incorporating into my work. It is difficult to see things within yourself and the culture around us.

David Freeburg, in *Iconography Between the History of Art and the History of Science, and the Case of the Urban Bee*, relates the power of the Catholic Church to control how people thought and what they believed. The bees were the symbol of Pope Urban III (corporate branding in 1623), and were used everywhere to venerate him.

Galileo, the microscope, and a writer named Stelli, threatened the Church's authority because they showed that invisible things exist and that knowledge didn't have to belong only to the elite. <sup>144</sup>

This article, contrasting treatises visually and verbally, demonstrates the classist structure behind knowledge and power. I realized that corporations fund both art and science. Power that controls also forms, so the institutions that fund the grants have control over what gets examined. In this capitalist culture the grants are much less abundant in areas that don't produce a profit.

Researching and thinking about the work I am going to produce, in the larger context of the culture I live in and meanings it represents, has been useful as an intellectual "stepping back." The examination of the cultural contexts would allow for the existence of alternative perceptions, interpretations, and reactions that could incorporated in the early stages of design instead of nasty surprises when it is too late.

# **3 METHODOLOGY**

This dissertation explores the ability of light to embody and enhance the spirit of place in the Big Bend section of West Texas. A series of surveys and research investigated and then paired elements of light and place (Phase 1) that were designed, built, or simulated in four experiential case studies (Phase 2). The relative success or failure of each study was evaluated by experts in the lighting field and members of the dissertation committee (Phase 3).

In the latest book on architectural research, published in 2002, Groat and Wang define different research approaches and types. This work fit into a number of these categories simultaneously. In the last chapter, Groat and Wang describe an approach called "combined research strategies, or triangulation," claiming that, "...architecture is a multidisciplinary professional field. Yet to date, much architectural research has remained within the confines of sub disciplinary topic areas, such as environmental technology or architectural history." This, they believe, is due to fewer established rules and procedures for combined research strategies, and that, "the researcher who uses them must exercise more care and build on a greater range of knowledge in research methodologies." They also, "believe that architectural research that combines strategies represents an important and necessary frontier in our field." <sup>145</sup>

This inquiry "triangulates" three methodologies; a qualitative interpretive field survey (Phase 1), simulations in five case studies (Phase 2), and evaluations by experts and analysis of the project results (Phase 3). Additionally, a decade spent as a

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professional architectural lighting designer, previous and ongoing research in the history of architectural lighting design, the collecting of hundreds of architectural lighting images in the form of postcards, and designing and building with light have allowed me a "greater range of knowledge" and experience. This expertise is a tool in this investigation.

The interpretive field survey chooses the place components, site locations and type of light used in the simulations/installations. The selections are qualitative and based on the following premises: "knowledge is a socially constructed reality and cannot be generalized; we only know by developing an in depth, intimate understanding. The case studies will be thematic in content analysis with a descriptive focus." <sup>146</sup>

#### 3.1 Case Study # 1 Architecture of Colored Light

Location: Big Bend National Park, see Fig. 78, the pink arrow at the bottom. <u>Aspect/Embodiment of Place</u>: Geology, the colors and processes of volcanism. <u>Aspect/Embodiment of Light</u>: Sunlight and ultraviolet light filtered from sunlight. <u>Aspect/Embodiment of Time</u>: Never stops, ever- changing, eternal. The angle and movement of the sun through the day and season will change the locations and intensities of the colors, shadows, and reflections as they move across surfaces. <u>Description of Installation</u>: The Architecture of Colored Light is a structure made of glass that is symbolic of the surrounding volcanic geology; both were formed in a liquid state with heat, force, and gravity. The structure has both outside elements that you can walk around and inside elements that enclose. The inside/outside is representative of the expansiveness of the views that invite contemplation and introspection. The structure does two things, the sunlight through glass projects color and reflections onto your skin and walls (open and expansive), and ultraviolet light is filtered out of sunlight causing some of the glass to fluoresce (closed and introspective).

### 3.2 Case Study # 2 Trains

Location: Sanderson or other train crossings.

<u>Aspect/Embodiment of Place</u>: Trains opened the West; this is the main southern line that connects New Orleans to San Diego, see Fig. 78, the East to West purple arrows. <u>Aspect/Embodiment of Light</u>: Shadows and flash.

<u>Aspect/Embodiment of Time</u>: The shadows portray the present; projections are already one step away in the past. Strobe lights stop time by freezing motion. This freezing of time represents the train schedules that required time zones to be constructed across the world and synchronized time.

<u>Description of Installation</u>: While stopped at a train crossing, the train is backlit (in shadow) as it is moving past. The strobe lights are synchronized to illuminate the background and architecture glimpsed between the spaces of the train cars; the lights go out as the train vanishes.

# 3.3 Case Study # 3 Three Cultures

<u>Location:</u> Clouds in Seminole Canyon (Fig. 78 lower right purple arrow) or the rock face of the Rio Grande near Castelon (Fig. 78 lower pink arrow), or the Marfa Court House (Fig. 78 upper left purple arrow)

<u>Aspect/Embodiment of Place:</u> The past and presence of three cultures, the Spanish, Native American, and Anglo, are represented by what they have left behind in the project area. A series of art and architecture images associated with each culture are projected onto clouds, rock faces, or architectural structures.

<u>Aspect/Embodiment of Light</u>: Large-scale projections overlay the existing.

<u>Aspect/Embodiment of Time</u>: Clouds in motion are ever-changing, happen at a certain time of year, and are elusive wisps like the culture's past. The rock escarpment represents geologic time and forms a long and large projection surface.

<u>Description of Installation</u>: Large-scale images of the art and architecture of three cultures, missions, cave paintings, and Minimalist Art, etc., are projected onto passing clouds or rock or architecture, a display of the cultural "greatest hits" of West Texas. See precedent studies in the previous section and Fig. 72.

#### 3.4 Case Study # 4 Wind

Location: Near Bakersfield and Fort Stockton visible from Interstate 10 (Fig. 78 upper blue arrows).

<u>Aspect/Embodiment of Place</u>: Present and future technology. There are thousands of these; the scale individually is huge, and understood only from a plane. Wind events happen because of the mesa tops that are the beginning of the Rocky Mountains, regular winds blow from different directions seasonally.

<u>Aspect/Embodiment of Light</u>: Laser lines trace the many miles of transmission lines and bounce off the blades of the turbines, like tennis balls volleyed across the valleys from the tops of the mesas.

<u>Aspect/Embodiment of Time</u>: The patterns are changeable and controllable by the audience from cell phones. Wind events activate the "show" at night; a wind event could

be a change of direction, the efficiency of a certain speed, etc. The turbines are future technology in the present.

<u>Description of Installation</u>: There are thousands of turbines, often three hundred in a farm. There are many farms around Bakersfield and Fort Stockton, a few visible from miles away on Interstate 10. The colors of the blades would encourage cars on I-10 to discover them. The road trip sculptures would begin there and beckon/lead to the other case studies located to the south.

### 3.5 Case Study #5 The Road Trip

<u>Location</u>: Along the road sides connecting the previous four case studies and located within the project area (Fig. 78 all major roads connecting all arrows).

<u>Aspect of Place</u>: Sculptures connect special sites within West Texas (Fig. 78, most northerly purple arrow), with the four case studies/simulations. The forms of the sculptures are based on the places that connect them. For example, the group that went from Sanderson to the MacDonald Observatory would change from trains to star constellations in multiple installations over hundreds of miles.

Light: Sunlight and car and train headlights.

<u>Time</u>: Experienced at 70 mph in motion, the sculptures light up and go dark as you pass, come to life and die, time is finite.

<u>Description</u>: The sculptures connect transportation corridors on the ground by marking/announcing special features within the study area. The sculptures are the path, are located on the road sides, and are constructed of reflective signage. The sculptures will be in a series of open forms that reflect light, stack up and fall down, much like a

cartoon and based on place. At night the colors seem to glow and hover. Illuminated in the narrow cone of light from the car headlights, they light up from far away; grow larger and go dark as the headlights pass. The forms of the sculptures will translate aspects of the specific places where they are installed; locations are established by a set of rules.

#### 3.6 Process/Phases

#### Phase 1: Background, Survey, Place, Light, and Site Selections

Phase 1 involved a literature review on pertinent precedent studies. Next, the project area within the Big Bend section of West Texas (Fig. 78) was selected. The individual sites for each case study/simulation were located within the project area. Contemporaneously, Phase 1 defined the attributes of place (the Big Bend section of West Texas) that would be simulated in light by the five case studies, and chose the type of light used in each simulation.

<u>Criteria for the selection elements of place</u>: Somewhat obvious, elements that make Big Bend different from other places and special.

<u>Criteria for the selection of case study/simulation locations</u>: The elements of place (above) are felt, strongly visually, and include the other senses (touch, smell, sound) whenever possible. The sites will be noticeable, notable, interesting, and evoke a sense of surprise and/or discovery.

<u>Criteria for the selections for the type of light</u>: reinforces the location and element of place above, there will be one place aspect per case study. The ability to combine place

elements and light is interpretive and uses research into light, sunlight, UV, strobe lights, headlights, lasers and my expertise.

#### Phase 2: Design, Build, and Record Case Study/Simulations

The five case study/simulations were extensively researched, with many materials tested. This included the movement and angles of the sun; a two week class in glass techniques at Corning in New York; plastic methods and forming, UV light, fluorescent materials, fluorescent paint; dichroic glass; structural tests of rebar and bungee cord; train shapes, types and history; the power requirements of strobe lights; railroad town layouts; the prehistory, history, art, and architecture of the Native American, Hispanic, and Anglo Cultures; projection lumen level requirements; wind speeds and patterns, wind turbine technology and funding, wind farm locations and construction; the transportation systems of Big Bend; many assorted maps of the project area; reflective distances of signage; wind destruction tests of reflective signage. I also assisted laser engineer Russell Wilcox with the laser set up for the Burning Man Festival, located in north western Nevada in August of 2002 to access the feasibility of laser use in the wind case study.

#### Phase 3: Evaluation and Analysis

According to Groat and Wang, for a "simulation to be meaningful, the researcher must supplement it with activities not directly in the domain of simulation. ...Interviews, checking records, and other types of qualitative fieldwork are necessary." <sup>147</sup>

Phase 3 was the descriptive evaluation of the simulations by three to five experts and the dissertation committee. An expert was defined as a published author on light and place. I researched and contacted four authors by phone a year and a half before the work was to be evaluated. All four were interested in attending. The five case studies were constructed and experienced by the experts and the committee and then evaluated in a survey that is discussed in the Results section of the dissertation. The evaluations are the final data, a form of participant observation, qualitatively described, and used to determine the relative success of the project. Data analysis documented patterns within and between the case studies, noting differences, shortcomings, and suggestions.

#### 3.7 Evaluative Survey

The following questions were devised to be given to the evaluators after experiencing the case studies.

- 1. Can light be used to enhance the sense of place?
- 2. Do these installations make "a place in light"? Will the built light installations become embodied by viewers? What about the video portions?
- 3. Can embodied light installations give viewers a sense of belonging to their surroundings?
- 4. Which case studies do this? Which don't? Why? Are there some that are better than others? Why? Are there similarities or parallels between the case studies? Are there similar conclusions that can be drawn about different kinds of light doing very different things?
- 5. What are the implications of scale?
- Time, expense, and permission prohibit installation of the case studies in West Texas at this time. The dissertation is based on very specific aspects of place, is it

valid to tweak them and not install them not in the location they were designed

for?

- 7. What are the strengths/weaknesses of the dissertation? Improvements?
- 8. Are there other ways the installations could be used?

### 3.8 Evaluators

Juror: Charles Linn, FAIA

Senior Editor of *Architectural Record* Former Editor of *Record Lighting* Founder of *Architectural Lighting Magazine* Author of many articles about light, architecture and place

## Juror: Marietta Millet

Architectural Lighting Designer Professor Emeritus, Univ. of Washington Architecture Author: *Light Revealing Architecture* Author of many articles about light, architecture and place

## Juror: Dick Peters

Practicing Architectural Lighting Designer Professor Emeritus, UC Berkeley Architecture Lighting Designer for Charles Moore, Lighting Designer for the1984 New Orleans World's Fair; Author of many articles about light, architecture and place.

Juror: Henry Plummer

Professor or Architecture University of Illinois Champaign Urbana Author: *The Light in Japanese Architecture*, Author of many articles about light, architecture and place.

# **4 RESULTS AND DISCUSSION**

The five case studies were originally designed to be full scale, in situ, based on, and located throughout the Big Bend section of West Texas. Unfortunately, due to the lack of public land in Texas; the time constraints involved in researching ownership, difficulties obtaining permission to install the works from private land owners and the State; the costs associated with building all the case studies at full scale; and unexpected challenges while designing, testing, and building the studies; full scale installations were not possible. Necessarily, the case studies became mock-ups of the original ideas. One was installed in situ and photographed, then reinstalled, two were simulated in video, and one was installed at Texas A&M (TAMU) Riverside Campus for night viewing. The original design intents, changes, challenges, limitations, locations, tests and results, of the case studies are discussed and illustrated below. This is followed by a summary of the evaluations of the case studies.

In the original proposal for this work, each case study had an element of time in addition to place and light aspects, making an already complex work more complicated. The concept of time was emphasized in the merged Trains/Three Cultures case studies, but deleted from the rest for clarity.

In March of 2005, I received a \$20,000 grant to finance the dissertation from the Nuckoll's Fund for Lighting Education. Without this funding, the dissertation would not have been achievable. The administration of this fund through the bureaucracy of Texas A&M proved very time consuming.

### 4.1 Architecture of Colored Light

#### Architecture of Colored Light-Original Design Intent

The design intent of the Architecture of Colored Light combined sunlight and geology, and the material was glass. The installation was intended to provide views that were expansive, and utilized UV light as the vehicle for introspection.

#### Location

The case study was designed and built twice. The first time it was installed with a crew of five at the Chimneys in Big Bend National Park in October of 2005. During the evaluator visit of April 2006, a different version was constructed on the roof of the Texas A&M University College of Architecture.

### Tests and Results

The work was originally designed with irregularly shaped chunks of glass that reflected and refracted colored light in interesting, non-geometric patterns (Figs. 97-98). In July of 2003, I attended a two week course at Corning Glass in New York, where I drilled; sand blasted, etched, engraved, chipped, sawed, polished, directed hot glass model forming, and tested the reflection, refraction and UV aspects of glass in multitudes of forms (Figs. 99-102). Glass is very beautiful, time consuming, and expensive to form; it is heavy, and a difficult construction material. Drilling holes in glass requires diamond bits used under water; these bits wore out and broke frequently. The weight of glass indicated that the structure necessary to maintain it would have been overwhelming and inappropriately proportioned the glass would have been become visually secondary to the form. Glass was rejected as the building material for the Architecture of Colored Light case study.

Subsequently I tested quarter inch thick plastic in sheets. The plastic was light in weight, easy to drill and attach, could be glued and stacked, and came in colors (Fig. 103). The shapes of the light reflected needed to be irregularly formed, which was not possible with the flat plastic in sheets. Next, large water tumblers with convex shapes were tested. The tumblers reflected light like lenses, came in eight different colors that mixed, formed additional colors when stacked together and also glowed under UV and in sunlight (Figs. 104-105). The first two sets of tumblers were bought and tested in 2003. When approximately 800 tumblers from Costco, Sam's, and Target were purchased two years later, the available color selection was four, not eight; this reduced the color palette.

I also tested, calcite (Figs. 106-107), color mixing in UV and daylight (Figs. 108-109), and dichroic glass reflection (Figs. 110-111).

I twice applied for and was granted a research permit to install the case study at the Chimneys in Big Bend National Park (Fig. 112), the first permit of this type which came with extensive restrictions. The project could not disturb dirt, rocks, or persons; there could be no stakes or anchors driven into the ground or rock faces; the project location could not interfere with the "wilderness experience" of park visitors; the installation was to be temporary; all materials had to be packed in and removed; no wheeled or motorized vehicles were permitted; and the project could only be installed during the "slow" tourist season. Chuck Tedrick, Alan Harmon, Natalie Bushman, all of Texas A&M, and Susie Douglas of the National Park Service, and I, installed the case study at the Chimneys. I organized, planned, and executed the logistics, transportation, feeding, and housing for a crew of five for two weeks in October of 2005. The supplies were purchased during the evacuation of Galveston to College Station in anticipation of Hurricane Rita, which delayed departure for three days, and gas prices rose to \$3.20 per gallon.

The Chimneys are a geologic dike; an overview of the site is shown in Fig. 113. Someone thought the "humps" of rock resembled "chimneys;" hence, the name. Close examination of Fig. 113 will reveal a very small white "dot" in the middle of the photograph, located below the curve of two central large rocks. Fig. 114 depicts the white "dot," it is a large rock (8' by 8') covered with mylar. This was done to illustrate the large scale and vistas of the site. The spindly "bush" next to the rock, on the right edge of the picture, is ocotillo. The trail into the Chimneys is almost four miles long, we transported on foot, and with backpacks; approximately 800 plastic glasses, rebar, glass chunks, supplies, and water. Each roundtrip to the site was about eight miles. On each and every trip some equipment had to be packed in or packed out in order to "leave no trace" of the project. In other words we could not arrive or depart empty handed. The installation was located on the west, or downhill, side of the tallest rock shown in Fig. 115. Please note the ocotillo to the right of this rock is the same ocotillo shown in Fig. 114. Figs. 116-117 show the installation from different angles.

The tumbler color combinations and light refractions were tested extensively (Figs. 118-120), and 80% of the tumblers were rejected on the basis of color. The case

study was designed to elicit a sense of the surrounding geology (Figs. 121-122). Please refer to Figs. 82-84 to see how rock changes colors under different lighting conditions. The geologic layers of the rock were implied by the colors of the glasses stacked in irregularly shaped, horizontal "stripes," and as a roof that provided shade from the desert sun (Figs. 123-124). The view was west to Santa Elena Canyon (Fig. 125) the 1700 foot deep canyon shown as the break in the rock on the horizon. The last week of the project was overcast and rainy. On the last day the sun came out for 20 minutes and the glasses made the reflections seen in Fig. 126. The pile of blue glass was the introspection aspect of the study (Fig. 127-128). If there had been days of sunshine, the pile of blue glass would have been aligned to catch the light at certain times of day, causing it to glow, the element needed for introspection. The original intent of the study was to record the reflected colors changing across the surfaces as the angle of the sun changed through the day; this was not possible with only 20 minutes of partial sunshine. According to the park rangers, the eight days of rain and overcast were unusual for the season.

In April of 2006, a second rendition of the architecture of colored light was installed on the roof of the TAMU College of Architecture utilizing the same materials. Again, the colors and reflections were tested (Figs. 129-131). The work was designed for the colored reflections; the form that resulted was secondary (Fig. 132). There were details of the roof installation that were successful; the colors and reflections in the stainless steel "bin" in Figs. 133-134; the view to the sky and reflections onto the walls (Figs 135-136); the UV fluorescence (Fig. 137); the pile of glass, its details, and its UV fluorescence (Figs. 138-140).

#### Changes, Challenges, and Limitations

Originally, lenses that filtered the UV out of sunlight were proposed. These effects were not visible with high levels of ambient sunlight, and to make the structure dark enough would have necessitated the blocking of the views, so I purchased an electric ultraviolet light. There was no electricity at the Chimneys in Big Bend: thus, in order for the UV light to function, a battery and generator were necessary. The electrical engineer that designed the UV light was not sure of the exact size of the battery except that it was large. Batteries and generators are very heavy and would have had to have been backpacked in and out of the site. Additional hours of work at night were not possible. I could not monopolize the video camera, a shared student resource, for the two week duration of the trip in order to record the UV effects. Time, expense, weight, and no records of the UV tests indicated that the BBNP installation would have to be without the UV component. Additionally, the lack of sunshine did not allow the recording of the reflected color across the surface over an entire day. I designed and built the second rendition of the work on the roof of the College of Architecture in order to test the UV fluorescence and record the reflected colors moving and changing across the surface over a day.

The Chimneys and the roof were chosen for; outdoor access to strong sunlight, corner areas with two surfaces for the reflections to fall upon, and southwest exposure to sunlight which allowed reflections later in the day. Both locations had extensive installation restrictions; there could be no anchoring to the ground or rocks at the Chimneys, and I could not penetrate the roof membrane or walls at the College of Architecture. These restrictions limited the structure necessary to sustain the forms; it had to be simple and lightweight.

At the Chimneys, the crew and I tested the tumbler color palette for two days and found that yellow blended with the rock best. We used every available yellow tumbler and did not have near enough, which limited the maximum size of the form, it was small.

The color palette of plastic tumblers from Costco had no relationship to the hundreds of subtle colors in the plants and rocks at the Chimneys. Additionally, the colors in the tumbler sets had dropped from eight to four, resulting in a reduced palette. Stacking the tumblers within one another blocked reflections. This indicated that differently shaped glasses had to be arranged on top of the other; the tumblers could not inadvertently fall together. This non-stack element required a rigid mounting system, rebar as opposed to bungee cords.

The colors reflected onto the rocks and roof walls in this work needed specific focal lengths to be effective. These focal lengths were dependant upon (1) the strength of the light striking the material, (2) the size of the material making the reflections and casting the shadow, (3) the angle of the material the sunlight is reflecting through/from, and (4) the distance of the reflection from the surface on which it falls. Here is an analogy. Picture a magnifying glass focusing sunlight onto an ant on the sidewalk. By moving the magnifying glass closer or farther away, the light is focused brighter/sharper or dimmer/softer upon the sidewalk. To fry the ant, the magnifying glass has to be held a certain distance and angle from the sidewalk. The tumblers are the magnifying glass. The sidewalk is the rock surface at BBNP or the walls on the roof. The ant is the best

focused reflection. If the magnifying glass was moved ten feet away from the sidewalk, there would be no reflection to fry the ant. If the magnifying glass was too close, the bright spot would go out of focus. The small size of the tumblers and short focal length indicated the tumblers had to be located close to the surface upon which they reflected; which was a limitation in the size of the space where one could sit. At BBNP the sitting space was very small. On the roof with the use of larger curved pieces, the space was much larger and taller.

The Chimneys, like the Big Bend section of West Texas, are an uncommon spot with a very strong spirit of place. The site was carefully selected after weeks of survey because of: long views, glimpses of variable volcanic forms, huge scale in an open countryside, hundreds of subtle changing colors in the surrounding rocks and plants, the textures of the sharp cactus and crumbly rock, the strong sunlight levels, and a long prehistory and history evidenced by the location of nearby petroglyphs, and names carved in to the rock. It was also four miles from a paved road and did not need a four wheel drive vehicle to access it, the trail was flat and it was an easy hike.

The roof of the College of Architecture was my only choice as the location of the second installation. The roof is not located in the study area of West Texas and does not have a strong spirit of place. It does not have long views due to the surrounding buildings; the building forms are only rectilinear. The scale of the views was limited and short. The roof had only three colors, one texture, no plants, the sunlight levels were lower, and there were no prehistoric, and few historic, connections. The weak spirit of place left few design parameters that the form could be based upon.

On the roof, I consulted with a structural engineer who advised me to rebuild if it fell down. Colored reflections are more aesthetically pleasing when made by asymmetrical forms. The taller structure indicated more complex colored reflections. I chose a symmetrical form because the structure needed to stand up to be effective and evaluated. And I needed a simplified form to be able to better understand how the colors changed in shape through the day. An asymmetrical form was not possible with the time constraint, building restrictions and my abilities. The final form on the roof resembled a strangely colored insect that was open to the sky. The simplified symmetry of the form and symmetrical colors detracted from the overall feeling and interpretation of the case study.

#### 4.2 Trains/Three Cultures

#### Trains-Original Design Intent

The original design intent of the trains case study was to allow viewers to understand trains as the link between the past and the present through the use of strobe lights that both illuminated the architecture framed by the space between the train cars in dramatic flashes, and put the train itself in shadow. This was designed to take place at one or more train crossings and to be demonstrated 'live' using real trains, at night, in downtown Bryan during the evaluator visit.

## **Three Cultures-Original Design Intent**

The design intent for the Three Cultures case study was to project images of Native American, Hispanic, and Anglo art and architecture onto passing clouds, or the fault block wall on the Rio Grande, or the Marfa Court House.

#### <u>Location</u>

The Trains/Three Cultures was a video simulation shown April 12, 2006. <u>Tests and Results</u>

Out of the hundreds of photographs taken during the ten trips to Big Bend, only horizontal images were useful to fit the proportions of the video screen. The Virgin Mary is venerated by the Hispanic community and commemorated in many interesting and vernacular shrines located throughout the area. The shrines and photos were vertical; and could not be used for the study.

The Trains/Three Cultures video is three minutes long. Native American cave paintings are projected onto the sky and hill in Figs. 142-143. Hispanic culture is represented by the ironwork in the cross in Fig. 144 and the adobe ruins in Fig. 145. Anglo architecture is shown with the Brite building in Fig. 146, and the wind turbines and Marfa Courthouse shown in Fig. 147.

Literally, the sun would have been too bright to view the projections during the day as depicted in the video; therefore the video is not literally "true." The design intent is still clear, if the trains were in shadow as originally intended, the effect of the framed projections would have been stronger.

## Trains Changes, Challenges, and Limitations

The frame made by the space between the containers on the train (Fig. 141) was integral to the project. These containers come off ships, are loaded onto trains and then are put on 18 wheel tractor trailer trucks and driven around the country. The flat cars of the trains had to be retrofitted to carry containers, which is the reason for the spaces that form the frames. Different kinds of trains are found in different areas of the country. The trains that run through downtown Bryan are trains that carry rocks, not containers. Rock trains have a very narrow space between the cars that do not make frames, i.e. they were the wrong kind of trains. As a result, the study could not be exhibited live and at full scale in downtown Bryan.

I videoed the moving trains and hired a student worker to simulate the effects with computer programs. I recorded the video twice, the first time in June of 2005, when I was lent an inferior camera. I was permitted to borrow a high quality camera (a shared and limited resource for students) capable of recording the effects in December. The tracks were always very busy with trains every half hour. However while I was shooting the video in early December, the tracks were shut down for a three day safety check. Only three trains went by in 12 hours during daylight, one of which was the wrong type, and no trains passed by during the night-time hours. This meant the trains could not be in recorded backlit in shadow as I had originally planned.

I had envisioned the case study to be experienced at railroad crossings that had interesting architecture, which would be revealed by the flash of the strobe lights. I discovered that the train tracks came first, the towns were built afterwards, and parallel to the tracks, the train tracks ran around and outside of the towns. I surveyed the towns of Langtry, Dryden, Sanderson, Marathon, Alpine, Marfa, and Valentine, and found no architecture close enough to the train tracks to be illuminated by the strobe lights. In the East, where I grew up, trains cut through towns, the towns were there first, the architecture was always built right up to the tracks. I had assumed incorrectly that this would be the case in West Texas. The video was viewed on a 6' by 4' screen.

## Three Cultures Changes, Challenges, and Limitations

I had planned to project the images onto the steam generated by the heating of Texas A&M University during the winter. I planned to film in January, the coldest month; however, January of 2006 was one of the warmest on record, the buildings did not have to be heated, there was no steam. I had to wait for the right temperature and film in the dark; however, the video cameras were in heavy use at this time of the semester and I had to reserve ahead without knowing if there would be steam available. I waited three weeks for steam, unsuccessfully. The Trains and Three Cultures case studies were combined into one case study instead of losing both. The art and architecture of the three cultures were projected onto a hill and the sky; the projections were visible through the frames made by the spaces between the containers on the train cars.

#### 4.3 Wind

## Wind-Original Design Intent

The original design intent of the Wind case study was to put viewers in touch with the ever present wind; the turbines represent this. It was proposed to volley dashes of laser light overhead between mesa tops during "wind events," i.e., the arrival of wind from a different direction, the most efficient speed at which the turbines produced electricity, etc. The transmission lines were also a part of the design where color combinations could be controlled from cell phones.

#### <u>Location</u>

The Wind case study was a video simulation shown April 12, 2006.

## Tests and Results

In October of 2002, I visited McCamey, Texas and was taken on a tour of the King Mountain "Wind Farm," where hundreds of turbines, each 350 feet tall, lined up along the mesa tops. Large areas along Interstate 10 and between Fort Stockton, Imperial, Crane, Rankin, McCamey, Sheffield, and Bakersfield were surveyed by car. Extensive research into wind turbine funding, erection, transport, technology, mechanics, and maintenance was conducted.

The footage for the video was shot twice, once in June of 2005 with an inferior camera, the second time in December of 2005. In December all the turbines around Bakersfield were "turned off," i.e., not turning because wind speeds were too low. Consequently the footage was filmed outside and around McCamey (Figs. 148-149). A four-minute video that explored the space between the blades (Figs. 150-151) and the use of the turbine blades to create changing and moving patterns in colored light resulted (Figs. 151-156).

## Changes, Challenges, and Limitations

I attended the Burning Man Festival in late August of 2002 and assisted the laser engineer, Russell Wilcox, from the Lawrence Livermore Labs in California. Burning Man is a week-long festival that takes place in the Black Rock Desert of northwestern Nevada. The festival ends with the burning of a 75 foot "man" constructed of wood, with neon, lasers, and fireworks. Wilcox's laser, located in the "man's" head, created directional lines for the festival and ran north to south, and east to west. Wilcox purchased the parts and constructed the laser and timing devices at home in his spare time. Even one laser was not within the budget, and I did not have time to pursue the endless permits and permissions necessary to install it "live." <sup>148</sup>

When I first visited the turbines near McCamey in the fall of 2002, there was open access along county roads. When I returned in December of 2005, the same roads were gated and locked. This limited the filming and viewing angles to far away, i.e., I could not get through the gates and did not have the time to obtain the security clearances in order to film closer.

Like the Trains/Three Cultures video, there was one part of the turbine clip that was not literally "true." The footage showed patterns across the full screen that resembled frogs swimming. This effect was achieved by turning some blades in the opposite direction. In reality, the turbines all face in the same direction and turn at the same speed in a clockwise motion. The video was judged to be successful, the movement of the color and light of the blades "mesmerizing."

Each turbine is 350 feet tall; there are minimally eight in a line. The huge scale is hard to imagine and did not come across strongly in the video and its projection on a 6' by 4' screen.

A variable speed model to test different color variations would have been helpful but beyond both my capabilities and budget.

### 4.4 Road Trip

#### Original Design Intent

The original design intent of the Road Trip case study combined car headlights and the path in a series of road side art sculptures that connected interesting places within the project area and all the case studies in this dissertation. The material was reflective signage; the forms were visually related to the location in which they were installed. Between the beginning and ending sites were smaller installations that changed from one to the next. In other words these were a series of locations that were experienced like a cartoon at 70 MPH over many hundreds of miles of road. Location: The Road Trip case study was a mock up and installed along the roads at Riverside Campus TAMU and viewed during the Evaluator visit by car, at night, on April 12, 2006.

## Tests and Results

The case study was investigated in a design studio in Spring of 2002 and a design methodology class in Spring of 2004.

The design studio explored how the individual sites of installations were to be chosen. The test area began at the intersection of Highway 79 and Highway 6, and continued six miles along Highway 6 to downtown Calvert. Two 50 foot maps were provided by the Bryan Texas Department of Transportation (TX DOT) office. Utilizing the maps, the locations were selected by the intersections of the various visual elements along the road (trees, bridges, creeks, railroad tracks, landmarks). This was combined with the rhythm created by driving up and down the hills and valleys of the road. In Fig. 157, the road is represented by the ribbon on the diagonal that runs through the various visual elements indicated by the different color stripes.

In the design methodology class, I worked on determining the forms of the reflective signage. The study area was between Sanderson, along approximately 120 miles of mostly Highway 90, to the McDonald Observatory (Fig. 78 the purple arrows). Sanderson was the location of all the housing/staging of men and supplies when the track was constructed through to San Diego in the 1880s. The McDonald Observatory was constructed in the 1940s, one of less than a dozen observatories at that time in the United States. I picked the train as the beginning design element, and a constellation, the representative of the McDonald Observatory, as the ending element. The reflective signage installations began shaped as trains. Then through multiple installations over the 120 miles between locations the train would morph into a constellation.

These two design exercises gave the "rules" for the locations, and what the beginning and ending forms would be. Because the case study was going to be mockedup at Riverside Campus and not between Sanderson and the McDonald Observatory, I ended the exploration there and I turned my attention to Riverside.

Riverside Campus was surveyed by car and on foot from March 2005 to March 2006 in order to determine the locations that would best embody aspects of the campus. Figs. 158-160 show a map of the campus overlaid by the route with the locations of the installations. These included: the fence along the entrance; the right turn onto the #1 runway; the right turn onto the #3 runway; the hill, the right turn back onto the #2

runway; the mural; the right turn onto the #1 runway; the tower; the last road intersection before the lake; and the lake itself.

The Road Trip installation was an exploration of the material of reflective signage. I designed the signage in as many different configurations as I could to discover the material's assets and limitations. Riverside Campus is very windy. Many different sizes and color combinations of material were constructed and wind tested (Figs. 161-163). In every case the wind destroyed the pieces and the connectors in several hours, days or weeks (Figs.164-165). The wind indicated that the installations could not have much surface area, and had to be made of many small pieces (Fig 166). The distance between the headlights and the signage was also tested. Careful examination of Fig. 167 will reveal two, very small colors spots in a dark background. The color spots are pieces of corrugated plastic with reflective signage mounted on them. The photo was taken from more than a quarter of a mile away. Fig. 168 depicts the wind tests of signage mounted on nets and hung on steel cable; the same tests are shown in Fig. 169 at night with headlight illumination.

The Road Trip installations are illustrated by Figs. 170-182. An approximate 200 foot long section of the fence that followed the curve of the road is shown in Figs. 170-172. The first turn onto the runway was marked by the "hairy" red object that moved with the wind in Fig. 173. The next turn was marked by the green "submarine" form shown in Fig. 174, this spun 360 degrees. The only hill on the campus is man-made. The hill served as the backdrop for the hundreds of small pieces of the gold reflective signage installation shown in Figs. 175-176. These were described as "butterflies," and moved

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forward and back in the wind. The blue and yellow partial circle in Fig. 177 marked another turn and bounced with the wind. Fig. 178 was a 75 foot wide and 24 foot long mural hung on steel cable that billowed up like a sheet on a clothesline. The next turn was marked by Fig. 174, a fabric ball that hovered on a short string. The tower, the tallest point of the campus, was highlighted in Fig. 180. The red and blue intersection marker in Fig. 181 spun and bounced. The last installation floated on the lake shown in Fig. 182.

#### Changes, Challenges, and Limitations

Riverside Campus was selected as the location for the following reasons: it is a campus of the university that I attend; it is located within driving range of the College of Architecture; it was an Air Force Base constructed in the 1930s that has distinctive characteristics, a strong spirit of place, and it is very dark on the runways i.e. there few lights that would wash out the effects of the installations.

The installations were designed to incorporate the spirit of the place Riverside Campus, at night, through the use of reflective signage in particular configurations. Although not the original location or scale, the mock-up was designed to give enough information of what the installations would feel like to be evaluated.

Reflective signage costs about \$5 per square foot, comes in minimum rolls of one to several thousand feet, and is sold exclusively to TX Dot. Until the Nuckoll's Grant in March of 2005 only small conceptual models were possible through the donations by Bryan TX Dot office.

The bureaucracy of Texas A&M, in terms of access, permission to install, and reserving the necessary sites; required large amounts of time in meetings, emails, phone calls, and presentations.

The choice of specific installation sites at Riverside was limited; they could not disturb any buildings or research. Originally conceived to be viewed at 70 MPH along hundreds of miles of road during day and night; Riverside Campus has approximately five miles of plane runways. There are no road shoulders on the runways, and the fields that separate the runways are blocked from view by trees. Consequently the individual installations were designed smaller in scale and located on or near the runway edges. Maximum speed on the short, unlit runways was 35 MPH. The Evaluators experienced the Road Trip only at night, it was logistically impossible to transport them there within the allotted time during the day.

One of the traffic engineers said the rule of thumb for reflective signage is one square inch of signage is readable from a distance of 40 feet. In tests, one inch of signage was visible from over a quarter of a mile away; additionally depth was not readable because there were no shadows, so everything appeared in the same plane. The sculptures were originally designed to be large and three dimensional. The reduction from hundreds of miles of exhibit space to six, the wind, the super brightness of the material, the lack of shoulders on the runways, and the absence of shadows to communicate depth, indicated installations needed to be a smaller scale made up of pieces small in size. I intended to climb the tower and apply reflective signage in interlocking diamonds all the way to the top. Citing safety issues, I was forbidden to go above ladder height by the TAMU Department of Facilities Planning.

The signage on weeds at the base of the hill was installed twice because the wind knocked the first batch out of alignment. The first time I cut the signage with a band saw so the edges were rough and "rumpled." The pieces for the second installation had a smooth edge. The first installation had a scattering effect; it looked like a swarm of gold bees surrounded it, and it made me cry involuntarily because of its beauty. The second installation did not have this swarm of golden bees, it less effective.

The Evaluators experienced the Road Trip in two cars, and I led the way in a third. I tried to rent a convertible for easier viewing, but this was not possible. One of the cars was driven by the Evaluator; this was the Evaluator who found the embodiment aspects at Riverside the weakest.

The Road Trip had five major installations; the fence, the weeds on the hill, the 75 foot by 25 foot mural, the tower, and the lake. It also had smaller pieces that were put at turns to mark a change in direction. The short distances at Riverside made these directional indicators less effective as they had to be located closer together. They were mounted on ten- foot-high wooden stands, which were visible at close range and took away some of the "magic."

About 25 cars experienced the Road Trip two nights after the Evaluator visit. The line-up of cars indicated that the red tail lights interfered with the installations. The line of cars also kept the works always in light so there was no surprise upon approach, or

sadness as they disappeared with the passing of the headlights. I could neither control where the cars stopped, nor the viewing angles.

## 4.5 Summary of Evaluations

#### Original Intent

There were originally four Evaluators, all authors of light and place, and additionally four dissertation committee members. The Evaluators were contacted by telephone; all were interested in participating in the project.

#### Location

The three evaluators, Linn, Millet and Peters were given the survey to complete after they departed from College Station on April 13<sup>th</sup> by email. Linn completed and returned his survey April 16. Millet returned her survey by email on May 15<sup>th</sup>. Peters gave me the answers to his survey verbally over the phone on April 16<sup>th</sup>, I took notes and later transcribed these. The Dissertation Committee were given and returned the survey electronically, Shepley and Downing returned the survey April 15<sup>th</sup>, Saslow by May 1 and Jamal by May 15<sup>th</sup>.

## **Results**

The Evaluators and Committee members reviewed the video of the Wind and Train/Three Cultures case studies, and the Architecture of Colored Light on the roof under UV light. Next, they toured Riverside Campus and the Road Trip installations, by car on the evening of April 12, 2006. The roof project was viewed under daylight conditions on April 13 following a presentation, questions, and discussions with and without the author. The survey was given to both the Evaluators and Committee members. A summary of the evaluations and the questions follow.

#### 1. <u>Can light be used to enhance the sense of place?</u>

All answered "yes." One added that light could also be used to alienate.

#### 2. <u>Do these installations make "a place in light?"</u>

The general consensus was that the Road Trip installations at Riverside Campus were the most successful in doing this because they were experienced "live" and had a sense of mystery and anticipation. Within the Road Trip study, there were differing opinions as to which ones did this best or worst.

The second installation of the Architecture of Colored Light case study on the roof was deemed unsuccessful. Although pieces of it were successful (the UV light, the glass rocks, the colored light reflections), as a whole it was not successful because the form was distracting and had no relationship to the place where it was installed.

The simulation of the Trains/Three Cultures and the Wind case studies in video form were evaluated as largely successful, although some commented that if this were experienced "live" like the Road Trip installations at Riverside Campus, the impact would have been greater.

3. <u>Will the built light installations become embodied by viewers? What about the video</u> <u>portions?</u>

Yes. The participants felt that the installations did/could become embodied by viewers, although not necessarily by everyone who viewed them and not every installation would be successful at doing this.

# 4. <u>Can embodied light installations give viewers a sense of belonging to their</u> <u>surroundings?</u>

Six of the seven participants thought that light installations could give viewers a sense of belonging, but not to every viewer in every instance. One felt that light, while clearly communicating a message, would not necessarily provide a sense of belonging.

5. Which case studies do this? Which don't? Why? Are there some that are better than others? Why? Are there similarities or parallels between the case studies? Are there similar conclusions that can be drawn about different kinds of light doing very different things?

These questions were answered similarly to question #2 above. The person who answered no to "belonging" in question #3 said that she felt a personal attachment to the Riverside weed installation.

## 6. What are the implications of scale?

The answers to this question were quite varied. Some talked about the size of the projects, some commented on the distance between the projects and the viewer. One added that the Road Trip was seen in motion so the scale changed. One said that the wind turbines experienced full scale could not really be imagined. A few answered that the scale of everything was/is huge, including the scale of West Texas.

7. <u>Time, expense, and permission prohibit installation of the case studies in West Texas at this time. The dissertation is based on very specific aspects of place, so is it valid to tweak them and install them in a different location than they were designed for?</u>

Six of the seven respondents said this was valid; one said it was a problem that would be solved by building a scale model.

8. <u>What are the strengths and weaknesses of the dissertation? If it was done again, how</u> could it be improved?

## **Strengths**

- envisioning original interventions in a site, the pursuit of the vision through a complex process of unfolding research and creativity
- great heights of technical and artistic accomplishment
- surprise, discovery, journey/pilgrimage
- beautiful ideas, beautiful concepts, beautiful installations
- Integrative combines light, landscape, culture, tourism, architecture
- very strong in concept
- redefines the nature of a dissertation

## Weaknesses

- communicating with the expert visitors
- the underlying research is known much better to the researcher than to her audience at this time
- needs more descriptions, explanations of precedents, connections between culture and place, embodiment, and intended experience

• it wasn't based on local elements and built locally saving time, money and increasing the amount of students that could experience it

#### 9. Are there other ways the installations could be used?

Yes, residentially, in healthcare facilities, highways, as way-finding landmarks in complex institutions, in places with different kinds of light, and in the actual places for which they were proposed.

## Survey and Evaluator Changes, Challenges, and Limitations

Henry Plummer cancelled three weeks before the review. There was not enough time to research, and make the arrangements for a replacement. Henry Plummer is very articulate in light and his insights would have provided more clarity. Frances Downing, the Chair of this Dissertation Committee, confirmed that three Evaluators were sufficient. The preparation, organization, logistics, communications, scheduling, travel arrangements, and driving required for the three Evaluators was quite extensive.

The date for the Evaluator visit was set a year ahead of time, the agenda sent out five months previously, and background information was also provided at an early date. During the evaluation I wondered if the information had been reviewed.

The amount of time set for the review was two hours on the evening of April 12<sup>th</sup> and three hours on the morning of April 13<sup>th</sup>. In five hours the Evaluators had to watch two videos, visit the roof at night and again during the day, travel to Riverside Campus, drive the five mile track and experience the Road Trip installations, listen to the author's presentation and then evaluate the dissertation as a group of seven. This was an ambitious schedule in light of the complexity of the work; it did not leave very much

time for detailed evaluation of the individual case studies. Scheduling seven busy professionals was difficult; I severely underestimated the time and coordination necessary to do this.

I did not want to influence the Evaluators' experiences of the case studies by explaining what they were going to see beforehand. The "magic," i.e., feeling the beauty of the installation, would have been deadened by the rationality of knowing the mechanics of what was being seen. A sense of discovery, surprise, and the newness of the experience is/was integral to a sense of wonder. I told the Evaluators only where we were going and that they were going to look at the case studies. Some seemed uncomfortable with this.

The group viewed the roof UV installation in the dark. There was not enough time for anyone's eyes to adjust to the darkness of the roof, and most were hesitant to advance towards the work. The strangeness of the form and the UV light added to this reticence. One Evaluator found the UV light beautiful. I didn't allow enough time to view or places to sit in the work.

The Road Trip installation at Riverside was the most successful; all but one Evaluator thought that the beauty of the colored light installations was embodied by their experience there and connected them to the place.

This positiveness appeared to change when the Evaluators were asked to answer the survey questions. It seemed everyone wanted to know the "story," and felt the presentation hadn't provided it. This was a surprise; I do not think a "story" was/is necessary to evaluate the absence or presence of the beauty of light. The reaction to the survey was also varied; two of the Evaluators expressed their discomfort with the survey, even thought the questions had been provided two years previously. I felt that three Evaluators had a clear depth of understanding of the entire work; and the others understood most of the pieces. The ones that understood the pieces sometimes included referrals to writings that only they were familiar with in the survey answers.

My installation schedule started in December and proceeded for five months. During the Evaluator visit I was tired and not as articulate as I would have liked to have been, and I forgot to introduce everyone until the second day. I found out that I work intuitively; inside and surrounded by a project. The installations come to me in pictures without words; I know what I have to do, but I don't know why. The words take time to arrive, and I did not have enough of them during the Evaluator visit. I would have liked to have been clearer and asked more questions to clarify foggy areas. In retrospect, it might have been better to have taped a presentation when I was fresher. Or perhaps telling them numerous times what was going to happen may have been better. It is difficult to be inside and outside of a work and make all the arrangements.

The survey questions could have been written more clearly. Some responded to the second and fifth questions with the same answers, and some questions were ignored. I was generally disappointed with the responses and wished they were longer. I also would have liked to have all the work critiqued in detail; only one Evaluator mentioned the video, only one mentioned the roof in the UV light, and only one mentioned the Chimneys installation. Perhaps having visuals of each study during the presentation would have helped. It might have been more effective if each evaluator had one case study that they understood in-depth, and critiqued and reviewed it while the work was ongoing, not after its completion. Then, during the Evaluator visit, each person could share this expertise in one case study, and like a study group, evaluate the entire dissertation. Logistically I don't know if this would have been feasible.

## **5 FUTURE RESEARCH**

#### 5.1 Future Place Research

Regarding the study site, there were several issues I did not have the time to explore, including the role of flora, the nocturnal dessert, the experience of the river, and the impact of the rain. These topics could serve as material for a future study.

While I was reviewing thousands of photographs for inclusion in this work I realized that I forgot to incorporate the flora. I have hundreds of photographs taken in Big Bend National Park, at the Chimneys of the plants along the trail. Fig. 183 illustrates green ocotillo. In Fig. 184, the leaves are backlit and glowing. In Fig. 185, the ocotillo stalks are barren; its thorns apparent with the absence of the leaves. As the ocotillo ages, the trunk gets thicker and splits (Fig.186). Every time I visited the Chimneys, the ocotillo was different.

There are many species of cacti all along the four miles of the Chimneys Trail. Some cacti were "nubby" and green (Fig. 187), some a raspberry-yellow color (Fig 188). Cactus can have a silver sheen (Fig. 189), it can be blush pink (Fig. 190), or green and smooth with short needles (Fig. 191). Some cacti can be smooth and a mottled green/pink with long needles (Fig. 192), or a shriveled dusty fuscia (Fig. 193). Once I saw the "lipstick" buds of maroon (Fig. 194), and later the baby that resulted from those buds (Fig. 195). I was sad that I never saw any cacti in flower. All the cacti looked different with every visit.

I always looked at agave, and found it strangely exotic and fun. The 25-foot stems shoot up into the air (Fig. 196), the flowers looked like waiter trays, the rose-like smell of the blossoms attracted hummingbirds (Fig. 197), and it had the most wonderfully textured base with intriguing imprints (Fig. 198).

The only plant I witnessed in bloom was yucca, which transformed from garliclike cloves to blossoms in less than a 24 hour period (Figs. 199-200).

Every time I visited the Chimneys I observed and photographed changes in the plants as a way to get to know them better. These changes indicated weather that was wet or dry, temperatures that ranged from very hot to cold, they manifested different light intensity in the seasons of the year. Places are always changing, and the plants reflect this change, it was dynamic; they are never the same twice. Plants should have been a case study in this dissertation but I missed them, probably because the initial survey was done at 45 MPH, and the large project area.

I visited the Chimneys under different lighting conditions, during the June solstice where the sun moved to its most northern location. I visited close to the equinoxes of March and September, and in early December when the sun was farthest south. During these visits, the rocks were different colors and cast different shadows. All the work at the Chimneys took place during the day in order to utilize the sunshine. The desert is a nocturnal place; most of the animals sleep during the heat of the day and are active at night. I also missed this.

There are many small, bowl-like rocks that sit around the base of the petroglyph rock at the Chimneys. During storms, the "bowls" catch rain as it streams off the rock. Often the "bowls" have holes worn through the bottoms by the water. The holes took many years to form because BBNP receives less than ten inches of rain a year. I also missed the site in the rain.

I did not get to experience the Big Bend area from a raft on the Rio Grande through its many steep canyons. I did not get to view the area from a plane or take the Amtrak train through it. I did not cross the border into Mexico. All of these were beyond the allotted time and budget of the project.

In order to really "know" a place, it has to be experienced over long periods of time from all different perspectives and scales. This "knowing" or becoming more intimate with a place, results in a familiarity that helps formulate better designs. The dissertation happened on schedules during a finite time. I missed the plants, the rain, the animals, and the night aspects of the Chimneys. I missed the different views and perspectives that would have been offered by rafting the river, taking the train or a plane, and visiting the Mexican border towns. All of these are important aspects of the Big Bend area of West Texas and would have deepened my understanding of it, resulting in stronger designs.

## 5.2 Future Light Research

Regarding light research per se, I didn't have enough time to fully explore and include calcite, UV color mixing, UV fluorescent rocks, plastic, dichroic glass, or LED lights in the mock-ups of the case studies of the Architecture of Colored Light. Figs. 201-202 depict the reflections made from the dichroic glass and plastic lenses that are in the window in Fig. 203. I did not get to form plastic objects with longer focal lengths

and interesting shapes. Samples of this are shown in Fig. 204. These are the future directions of the Architecture of Colored Light case study.

### 5.3 Future Exhibitions

The embodied experience is not solely visual. Although this work was limited to the visual, usually more than one sense is involved. At the Chimneys I could smell the greasewood, and the approaching rain. I could taste the dust, and the dryness. Cactus needles in my shins reminded me to stay on the trails. I could feel the heat of the sun on my skin. This work was biased and exclusively visual. Future exhibitions might endeavor to incorporate these sensorial experience.

#### 5.4 Future Evaluators

In the last year, I discovered that Motoko Ishii had executed some aspects of two of the case studies; she would be an excellent Evaluator.

## 5.5 Future Dissertation Models

The structure/processes of dissertations are based on the more traditional, rational, scientific, critical and quantitative models. The scientific models have been called "objective" and often measure. This dissertation "measured" the effectiveness of the work through the Evaluators. The traditional process PhDs requires numerous "defenses," by the student to "prove" the dissertation, and it is based on words. True creativity needs a positive environment in order to flourish, which was provided by this dissertation committee. If the dissertation model was to become open to alternative forms, more creative dissertations would be the result.

## 5.6 Future Research Applications

One Evaluator said that the Road Trip concepts could be used in way-finding, to lay out a path indoors or outdoors to provide a better understanding of "where you are." Another said it could be used as a "road beautification" program similar to the planting of wildflowers on the roadsides by Lady Bird Johnson in the 1960s.

Another Evaluator suggested that the Train/Three Cultures study could be used for cultural heritage interpretations, where connections were made to people of the past and present.

The Architecture of Colored Light could be used in hospitals to promote respite, relaxation, and a more healing environment.

The Wind study could be used to educate and promote natural energy resources. Wind Farm construction is currently opposed by residents of Cape Cod, but well received in Holland and Europe. The movement of light and color, in motion, reflecting upon the water would be quite beautiful. The movement could be choreographed like the fountain at the Bellagio and perhaps their beauty could help ease some of the opposition.

## 5.7 Future Research Suggestions

- Live on the site for a year if feasible.
- Don't forget the plants, the animals, the rain, the night, the seasons.
- Select sites with a strong spirit of place with strong personal connections.
- Examine the site from many different scales.
- Explore the edges for a fuller understanding of the area.
- Use colors with a relationship to the place.

- Demonstrate live, full scale or as large as possible.
- Control viewing angles during exhibitions.
- Inform Evaluators that you will not be telling them what to expect.
- Hire an administrator, a structural engineer, and photographer.

## 5.8 Case Study Comparisons

Two case studies were built and inserted into the environment and experienced actively or "live," the Architecture of Colored Light and the Road Trip. Two case studies were simulated in video, the Trains/Three Cultures and the Wind, these were viewed passively.

The strongest and most universal opinions were expressed about the works that were experienced "live." The form of the roof installation was found by all to be distracting, and the installations of the Road Trip deemed most effective. There was also confusion/disorientation produced by these two during night viewing. On the roof the form was approached with caution, and at Riverside not knowing where they were was disconcerting to some Evaluators. At night, the connection to place is weaker and the connection to the dark is stronger. Darkness, like light, is processed unconsciously and is felt to be "scarier" than daytime.

When building and inserting into an environment it is more difficult to provide an enhancing connection to the place with the installation that is inserted. The installation could also be viewed as distracting/detracting instead of enhancing the sense of place. The roof form, the least "successful" of all the installations, provided the most information about what the installations should not do. It let me know that even when the form is based solely on light the form counts. It let me know that man made environments are less complex than those in nature and can have a weaker sense of place, resulting in watered-down design elements and a weak design. I chose the Big Bend area of West Texas for this study because it is a spectacular location with many strong elements to base designs on. I felt a strong personal connection to it. Without strong elements of place, the design and resulting connection to the surroundings is weaker. The "inserted" form makes people notice their surroundings because there is something different in it. Some will find this exciting; others will find it an intrusion.

The two studies simulated in video provided the visual idea of what I was proposing. The videos would have had a bigger impact if the projected size had been larger. If the Train/Three Cultures had been exhibited "live," it would have been more effective than the video. If the Wind study was produced "live," it would have been the most effective of all. It would seem from this work that in the case of light installations bigger is often best. Because these studies were not insertions into the environment, I think the embodiment of their beauty would be different, but I don't know how without installing at full scale and, "live."

The case studies seem to fall into two types. The first uses the existing light in the place, and inserts the installations to "catch" the light there. The second uses the existing place and inserts the light into it.

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#### 5.9 Conclusion

The evaluations of this work found it largely successful; the beauty of light can be embodied to provide a connection to place. Not everyone will experience this embodiment, and not on every occasion. Some will not want, enjoy or care about light or beauty. Some will already be in touch with it and not "need" to experience the installation in order to appreciate the place around them. Some will object to the installations, but as the Gates in Central Park demonstrated, millions came to experience them and often felt happy.

The September 4, 2006 issue of *Time Magazine* featured "*Innovators Forging the Future*." They were: Willie Williams, the lighting designer for the band U2; Olafur Eliasson, the artist of the "Sun Machine" exhibited in the Tate Gallery; The Graffiti Research Lab, designers of lights that make public art when "thrown" onto metal surfaces in cities; and Angus Farquhar, who designs and installs sound and light "extravaganzas" in large outdoor spaces. Whether in a rock concert, a museum, throwing lights in the city, or hiking miles up the side of a mountain, these works offered places where interest, excitement, and joy were provided by the art of light (and often other senses). <sup>149</sup> This is also the essence of this PhD; light. the use of shadow, reflection, color and glow can offer transcendence to different emotions and states of mind, in this case, a quiet joy through beauty acting as a connection to the surrounding spirit of place.

## NOTES AND REFERENCES

<sup>1</sup> Brenda M. Farnell, *Do You See What I Mean? Plains Indian Sign Language and the Embodiment of Action* (Austin, TX: University of Texas Press, 1995) p. x.

<sup>2</sup> Eudora Welty, *The Collected Stories of Eudora Welty* (New York: Harcourt Brace Jovanovich, 1980) p. 454.

<sup>3</sup> Maya Lin, *Boundaries* (New York: Simon & Schuster, 2000) p. 5.05.

<sup>4</sup> Joseph Rael, "Methods of the Soul" (March 2001):http://www.duversity.org/ articles/Methods%20of%20the%20Soul2.doc.

<sup>5</sup> Welty [2] p. 126.

<sup>6</sup> Ellen Melloy, *The Anthropology of Turquoise: Reflections on Desert, Sea, Stone and Sky* (New York: Vintage Books, 2002) p. 126.

<sup>7</sup> Alberto Perez-Gomez, *Built upon Love: Architectural Longing after Ethics and Aesthetics* (Cambridge: MIT Press, 2006) p. 7.

<sup>8</sup> Mark Morford, "God is in the Magic Mushrooms" *SF Gate Friday* (August 4, 2006): http://www.sfgate.com/cgiin/article.cgi?file=/gate/archive/2006/08/04/notes080406.DTL

<sup>9</sup> Philip Fisher, *Wonder, the Rainbow and the Aesthetics of Rare Experiences* (Cambridge: Harvard University Press, 1998) p. 1.

<sup>10</sup> Morford [8].

<sup>11</sup> Julie Salamon, "Young Critics See 'The Gates' and Offer Their Reviews: Mixed," *New York Times*, February 17, 2005, Section E3.

<sup>12</sup> Robert Tuttle, "Viewfinder: The Central Park Landscape – Bracketed by Christo and Jeanne-Claude's 'Gates,' Takes on Vibrant Color and Verve." *Christian Science Monitor*, February 18, 2005, p. 12.

<sup>13</sup> Daniel Henniger, "Wonder Land: Christo's Gates Get Wrapped in Big Flap," *Wall Street Journal*, Eastern Edition, March 4, 2005, Section A.14.

<sup>14</sup> Blake Gopnik, "Christo's Gates: A Little Creaky," *The Washington Post*, February 13, 2005, Final Edition, Section D01.

<sup>15</sup> Melloy [6] p.164.

<sup>16</sup> Mark Pendergast, *Mirror/Mirror: A History of the Human Love Affair with Reflection* (New York: Perseus Books, 2003).

<sup>17</sup> John B. Carlson and James W. Judge, *Astronomy and Ceremony in the Prehistoric Southwest* (Albuquerque NM: Papers of the Maxwell Museum of Anthropology, 1983).

Jonathan E. Ericson and Timothy G. Baugh, *The American Southwest and Mesoamerica, Systems of Prehistoric Exchange* (New York: Plenum Press, 1993).

David Freidel, Linda Schele, and Joy Parker, *Maya Cosmos* (New York: HarperCollins, 1993).

Sally Midgette, *The Navajo Progressive in Discourse: A Study in Temporal Semantics* (New York: Peter Lang Publishing, 1995).

Susan Milbrath, *Star Gods of the Maya Astronomy in Art, Folklore and Calendars* (Austin TX: University of Texas Press, 1999).

Pendergast [16].

Linda Schele and Mary Ellen Miller, *The Blood of Kings: Dynasty and Ritual in Maya Art* (Fort Worth, TX: Kimball Art Museum, 1986).

<sup>18</sup> Enid Verity, *Color Observed* (New York: Van Nostrand Reinhold, 1980).

Victoria Finlay, *Color: A Natural History of the Palette* (New York: Ballantine Books, 2002).

<sup>19</sup> Arthur G. Abbott, *The Color of Life* (New York: McGraw-Hill, 1947).

R. Houstoun, Light & Color (London: Longmans, Green and Co., 1923).

Jane Wegscheider Hyman, The Light Book (New York: Ballantine Books, 1990).

Winston E. Koch, *Sound Waves and Light Waves* (Garden City, NY: Doubleday and Co., 1965).

M. Luckliesh, Color and Its Applications (New York: Van Nostrand Co., 1927).

M. Luckliesh, The Language of Color (New York: Dodd, Mead, and Co., 1918).

Marietta Millet, *Light Revealing Architecture* (New York: Van Nostrand Reinhold, 1996).

Kurt Nassau, *The Physics and Chemistry of Color: The Fifteen Causes of Color* (New York: John Wiley & Sons, 1983).

Richard Peters, ed., "Light in Place," *Places: A Quarterly Journal of Environmental Design* V8 No. 2 (Fall 1992) p. 2 – 64.

Charles Sheard. Life-Giving Light (Baltimore: Williams and Wilkins, 1933).

A.C.S. Van Heel, and C.H.F. Velzel, What Is Light? (New York: McGraw-Hill, 1968).

<sup>20</sup> Jennifer Steinhauer, "Barbarians (Well Mostly Art Lovers) at 'The Gates': Fans of Christo Descend." *New York Times*, February 9, 2005, Late Edition Section E1.

<sup>21</sup> Steinhauer [20].

<sup>22</sup> Welty [2] p. 256.

<sup>23</sup> Melloy [6] p. 23.

<sup>24</sup> Melloy [6] p. 24.

<sup>25</sup> Lo T'ai Po. "Exiles Letter," translated by Ezra Pound,1915:http://www.4literature.net/ Ezra\_Pound/Exile\_s\_Letter.

<sup>26</sup> Lin [3] p. 2.06.

<sup>27</sup> Sabrina Tavernise, "Bright Lights for the Big City? She's in Charge." *New York Times*, December 26, 2003, C11.

<sup>28</sup> Luc Lafortune, "Inspiration," *Professional Lighting Design Magazine*, No. 49, Spring 2006, p. 51-57.

<sup>29</sup> Lin [3] p. 2.03

<sup>30</sup> Lin [3] p. 2.08

<sup>31</sup> Melloy [6] p. 315.

<sup>32</sup> Margaret Mead, ed,. *An Anthropologist at Work: Writings of Ruth Benedict* (New York: Avon, 1973) p. 59.

<sup>33</sup> Mead [32].

<sup>34</sup> Melloy [6] p. 16.

<sup>35</sup> Melloy [6] p. 104.

<sup>36</sup> Melloy [6] p. 210.

<sup>37</sup> Melloy [6] p. 74.

<sup>38</sup> Melloy [6] p. 218.

<sup>39</sup> Jan Reid, *Rio Grande* (Austin TX: University of Texas Press, 2004) p. 261.

<sup>40</sup> David Buckland, *Burning Ice Art & Climate Change* (London: Lecturis Inc., 2006) p.
88.

<sup>41</sup> Lin [3] p. 3.07.

<sup>42</sup> Lin [3] p. 3.05.

<sup>43</sup> Lin [3] p. 3.07.

<sup>44</sup> Lafortune [28] p. 44.

<sup>45</sup> Lafortune [28] p. 51.

<sup>46</sup> Lafortune [28] p.53.

<sup>47</sup> Lafortune [28] p.47.

<sup>48</sup> Michael Kimmelman, "Wake Up. Wash Face. Do Routine/ Now Paint," *New York Times*, May 8, 2005, Section AR1.

<sup>49</sup> Kimmelman [48].

<sup>50</sup> Gladys A. Reichard, *Navajo Religion: A Study of Symbolism, Volumes 1 and 2* (New York: Stratford Press, 1950) p. xxxiii.

<sup>51</sup> Jay Griffiths, A Sideways Look at Time (New York: Penguin Group, 2004) p. 244.

<sup>52</sup> http://www.highbeam.com/doc/1G1-110737797.html.

http://www.public.asu.edu/~sswanson/atalaya/project.html.

http://www.sciam.com/article.cfm?articleID=000E4D56-850F-1C61-B882809EC588ED9F.

http://www.desertusa.com/ind1/du\_peo\_ana.html.

http://www.saa.org/publications/AmAntiq/68-4/Swanson.html.

<sup>53</sup> E.W. Egan, *Indian Signals and Sign Language* (New York: Bonanza Books, 1978).

Ericson and Baugh [17].

Farnell [1].

Migette [17].

Reichard [50].

Gary Witherspoon. *Language and Art in the Navajo Universe* (Ann Arbor, MI: University of Michigan Press, 1970)

Sol Worth and Richard Chaflen, *Through Navajo Eyes* (Albuquerque NM: University of New Mexico Press, 1997).

<sup>54</sup> W.D. Smither, *Chronicles of the Big Bend A Photographic Memoir of Life on the Border* (Austin, TX: Texas State Historical Association, 1999).

<sup>55</sup> Electronic communication from Professor David Freidel of Southern Methodist University, Dallas, TX to Jill Mulholland, 8 February, 2006.

<sup>56</sup> George Lakoff and Mark Johnson, *Philosophy in the Flesh* (New York: Perseus Books, 1999).

<sup>57</sup> Susanne K. Langer, *Feeling and Form* (New York: Scribners, 1953).

Susanne K. Langer, *Philosophy in a New Key* (Cambridge: Harvard University Press, 1979).

<sup>58</sup> Richard Bright, James Turrell Eclipse (London: Hatje Cantz Publishers, 1999).

Wolfgang Hausler, *James Turrell Lighting a Planet* (Ostifildern, Germany: Hatje Cantz, 2000).

<sup>59</sup> Linda Groat and David Wang, *Architectural Research Methods* (New York: John Wiley & Sons, 2001).

<sup>60</sup> Jane Amindon, *Radical Landscapes* (London: Thames & Hudson, 2001).

Kay Anderson, Inventing Places (New York: Wiley, Halsted Press, 1992).

Penny Bach, New Land Marks (Washington DC: Editions Ariel, 2001).

Gaston Bachelard, The Poetics of Space (New York: Orion Press, 1964).

Michael Conan, *Landscape Design and the Experience of Motion* (Washington DC: Dumbarton and Oakes Research Library and Collection, 2003).

Frances Downing, *Remembrance and the Design of Place* (College Station, TX: Texas A&M University Press, 2000).

Elizabeth Diller, Blur: The Making of Nothing (New York: Harry N. Abrams, 2002).

J.B. Jackson, *Landscape in Sight: Looking at America* (New Haven CT: Yale University Press, 1997).

James Howard Kunstler, *The Geography of Nowhere* (New York: Simon & Schuster, 1993).

Miwon Kwon, *One Place After Another: Site-Specific Art and Locational Identity* (Cambridge, MA: MIT Press, 2002).

Andrew Light and Jonathan Smith, *Philosophies of Place* (New York: Rowman and Littlefield, 1998).

W.J.T. Mitchell, Landscape and Power (Chicago: University of Chicago Press, 1994).

Paul Moorhouse, Richard Long: Walking the Line (London: Thames and Hudson, 2002).

Robert David Sack, *Place, Modernity, and the Consumer's World: A Relational Framework for Geographic Analysis* (Baltimore: Johns Hopkins University Press, 1992).

Simon Shama, Landscape and Memory (New York: A.A. Knopf, 1995).

Yi-fu Tuan, Space and Place (Minneapolis: University of Minnesota Press, 1977).

Peter Ucko and Robert Layton, *The Archaeology and Anthropology of Landscape* (London: Rutledge, 1999).

Lawrence Weschler, *Seeing Is Forgetting the Name of the Thing One Sees* (Berkeley CA: University of California Press, 1982).

<sup>61</sup> Light and Smith [60].

Jackson [60].

Tuan [60].

<sup>62</sup> Kenneth Baker, *Minimalism* (New York: Abbeville Press, 1988).

Christo and Jeanne-Claude, Early Works 1958-1969 (New York: Tashcen, 2001).

Marlais Hugh Davies, *Blurring the Boundaries: Installation Art 1969-1996* (San Diego: San Diego Museum of Contemporary Art, 1997).

Diller [60].

Erika Lee Doss, *Spirit Poles and Flying Pigs* (Washington DC: Smithsonian Institution Press, 1995).

Tom Finklepearl, *Dialogues in Public Art* (Cambridge: MIT Press, 2002).

Andy Goldsworthy, Collaboration with Nature (New York: Harry N. Abrams, 1994).

Andy Goldsworthy, Midsummer Snowballs (New York: Harry N. Abrams, 2000).

Andy Goldsworthy, Stone (New York: Harry N. Abrams, 1994).

Andy Goldsworthy, *Time* (New York: Harry N. Abrams, 2000).

Andy Goldsworthy, Wall (New York: Harry N. Abrams, 2000).

Andy Goldsworthy, Wood (New York: Harry N. Abrams, 1996).

Moorhouse [60].

Robert Peacock, *Paradise Garden: Howard Finster* (San Francisco: Chronicle Books, 1996).

Jorg Schellman, *Christo Prints and Objects*, 1963-1987 (New York: Abbeville Press, 1988).

Joan Simon, Ann Hamilton (New York: Harry Abrams, 2002).

Wolfgang Volz, David Bourdon and Michael Cullen, *Christo and Jeanne-Claude:* Wrapped Reichstag, Berlin 1971-95 (New York: Taschen, 2001).

<sup>63</sup> Dave Hickey, *The Invisible Dragon* (Los Angeles; Art Issues Press, 1993).

Donald Kuspit, Redeeming Art (New York: Allworth Press, 2000).

Lucy R. Lippard, *Lure of the Local* (New York: New Press 2001).

Lucy R. Lippard, On the Beaten Track (New York: New Press, 1999).

<sup>64</sup> Suzan Boettger, *Earthworks Art and Landscapes of the Sixties* (Berkeley: University of California Press, 2002).

Michale Govan and Tiffany Bell, *Dan Flavin: A Retrospective* (New Haven CT: Yale University Press, 2004).

Nancy Holt, *The Writings of Robert Smithson* (New York: New York University Press, 1979).

Jeffrey Kastner, Land and Environmental Art (London: Phaidon Press, 1998).

Maureen Korp, *Sacred Art of the Earth: Ancient and Contemporary Earthworks* (New York: Continuum, 1997).

Pamela M. Lee, On Time in the Art of the 1960's (Cambridge: MIT Press, 2004).

Lucy R. Lippard, *Overlay: Contemporary Art and the Art of Prehistory* (New York: Random House, 1995).

Mary Miss, Mary Miss: Projects, 1966-1987 (London: Architectural Association, 1987).

Julie H. Reiss, *From Margin to Center: Spaces of Installation Art* (Cambridge, MA: MIT Press, 1999).

Schellman [62].

Gary Shapiro, *Earthwards: Robert Smithson and Art After Babel* (Berkeley: University of California Press, 1995).

Erika Suderburg, *Space, Site, Intervention: Situating Installation Art* (Minneapolis: University of Minnesota Press, 2000).

Giles Tiberghien, Land Art (New York: Princeton Architectural Press, 1995).

Eugenie Tsai, *Robert Smithson Unearthed* (Minneapolis: University of Minnesota Press, 1977).

<sup>65</sup> Lee [64].

M. Maloney, "Mono 2000 + Process Art," Artforum V35 (2): 36-37 (October 1996).

Michael Reed, "Process Art at CSU Bakersfield," Artweek V28, No. 25-26 (Je1997).

Kristine Stiles and Peter Selz, *Theories and Documents of Contemporary Art: A Sourcebook of Artists' Writings* (Berkeley: University of California Press, 1996).

Suderburg [64].

Reiss [64].

<sup>66</sup> Bright [58].

Jan Butterfield, *The Art of Light + Space* (New York: Abbeville Press, 1993).

Frances Colpitt, "Space City Takes Off," Art in America (October 2000) p. 67-75.

Dan Flavin, Dan Flavin: 1972-1975 (Texas: Fort Worth Art Museum, 1976).

Eric Frederickson, "Roden Crater" Architecture V4, No. 2, 90-97.

Govan [64].

Wade Graham, "At Play with Night and Day in the Desert," *Los Angeles Times*, (Feb. 17 2002) p. 1-11.

William L. Hamilton, "Quaker Simple, Simply Beautiful," *New York Times* January 11, 2001 Section B12.

Hausler [58].

Michael Kimmelman, "The Forgotten Godmother of Dia's Artists," *New York Times* May 11, 2003 p. 19.

Fiona Rageb, *Dan Flavin: The Architecture of Light* (Berlin: Deutsche Guggenheim, 1999).

Paul Trachtman, "James Turrell's Light Fantastic" Smithsonian, (May 2003) p. 86-93.

<sup>67</sup> Wiebe Bijker, Thomas Hughes, and Trevor Pinch, *The Social Construction of Technological Systems* (Cambridge MA: MIT Press, 1996).

Jon Prosser, Image Based Research (London: Falmer Press, 1998).

Caroline A. Jones and Peter Galison, *Picturing Art, Producing Science* (London: Rutledge, 1998).

Bruno Latour, "Visualization and Cognition: Thinking with the Eyes and Hands," *Knowledge and Society: Studies in the Sociology of Culture Past and Present* (1986) pp. 1-40.

Leonard Shlain, *Art and Physics: Parallel Visions in Space, Time and Light* (New York: Harper Trade, 1993).

C. P. Snow, The Two Cultures (New York: Cambridge University Press, 1998).

<sup>68</sup> Guy Debord, *Comments on the Society of the Spectacle* (London, New York: Verso, 1990).

Hickey [63].

Kuspit [63].

Prosser [67].

<sup>69</sup> Lakoff, and Johnson [56].

<sup>70</sup> Langer, 1953 [57].

<sup>71</sup> Langer, 1953 [57].

<sup>72</sup> Langer, 1953 [57].

<sup>73</sup> Hausler [58] p. 54.

<sup>74</sup> Bright [58] p. 241.

<sup>75</sup> Downing [60].

Goldsworthy, 1990 [62].

Jackson, 1997 [60].

Kuspit [63].

Langer, 1953 [57].

Light and Smith [60].

Lippard, 1995 [63].

Lippard, 2001 [63].

Mitchell [60].

Peacock [62].

Schama [60].

Tuan [60].

Ucko [60].

<sup>76</sup> Downing [60].

<sup>77</sup> Jackson, 1997 [60].

<sup>78</sup> Light and Smith [60].

<sup>79</sup> Goldsworthy, 1994 [62].

<sup>80</sup> Lippard, 1995 [64].

<sup>81</sup> Kuspit [63].

<sup>82</sup> Henniger [13].

Jill Mulholland. "A Light Unto the World" Metropolis Magazine (May 1998) p. 72 – 76.

<sup>83</sup> www.maxopus.com.

Peter Maxwell Davies. Antarctic Symphony. (London: Chevalier, 2001).

<sup>84</sup> Buckland [40].

<sup>85</sup> Buckland [40].

<sup>86</sup> Buckland [40].

<sup>87</sup> Abbott [19].

Houston [19].

Hyman [19].

Kock [19].

Luckliesh [19].

Luckliesh [19].

Nassau [19].

Millet [19].

Mark Major, Jonathan Spiers, and Anthony Tischauser, *Made of Light: The Art of Light and Architecture* (Boston: Birkhauser, 2005).

Peters [19].

Sherd [19].

Van Heel [19].

Arthur Zajonic, *Catching the Light: the Entwined History of Light and the Mind* (New York: Oxford University Press, 1993).

<sup>88</sup> Henry Plummer, "The Strange Rejuvenating Beauty of Radiant Things" *Architecture: the AIA Journal*, **V**76, No. 10, 66-75 (Oct. 1987) pp. 66-75.

Henry Plummer. Light in Japanese Architecture. (Tokyo: a+u Publishing, 1995).

<sup>89</sup> Pendergast [16].

Ericson [17].

Aveni [17].

Freidel [17].

Schele [17].

<sup>90</sup> Kevin Salatino, *Incendiary Art: The Representation of Fireworks in Early Modern Europe* (Los Angeles: Getty Trust Publications: 1998).

<sup>91</sup> Dietrich Neumann, *Architecture of the Night* (New York: Prestel, 2002). Salatino [90].

<sup>92</sup> T.C.W. Blanning, *The Culture of Power and the Power of Culture: Old Regime Europe, 1660-1789* (Oxford: University Press, 2002).

William Leach, *Land of Desire Merchants: Power and the Rise of the American Culture* (New York: Random House, 1993).

Deborg [68].

Patricia Mainardi, *Art and Politics and the Second Empire* (London: Yale University Press, 1987).

<sup>93</sup> Judith Adams, *The American Amusement Park Industry: A History of Technology and Thrills* (Boston: Twayne Publishers, 1991).

John Allwood, *The Great Exhibitions* (London: Cassell, Collier and McMillan Publishers, 1920).

Louis Bell, The Art of Illumination (New York: McGraw Publishing, 1902).

K.G. Beauchamp, *Exhibiting Electricity* (London: Institution of Electrical Engineers, 1997).

Brian Bowers, *Lengthening the Day: A History of Lighting Technology* (New York: Oxford University Press, 1998).

Charles Funnell, By the Beautiful Sea: The Rise and High Times of the Great American Resort, Atlantic City (New Brunswick, NJ: Rutgers University Press, 1975).

Alan Hess, *Viva Las Vegas: After Hours Architecture* (San Francisco: Chronicle Books, 1993).

John A. Jakle, *City Lights: Illuminating the American Night* (Baltimore: Johns Hopkins University Press, 2001).

John A. Jakle, *Postcards of the Night: Views of America* (Santa Fe: Museum of New Mexico Press, 2003).

Robert D McCracker, *Las Vegas: The Great American Playground* (Reno, NV: University of Nevada Press, 1996).

Malcolm MacLauren, *The Rise of the Electrical Industry During the Nineteenth Century* (Princeton NJ: Princeton University Press, 1943).

Ben Macomber, The Jewel City (San Francisco: John Williams Publishers, 1915).

Neuman [91].

David Nye, *Electrifying America: Social Meanings of a New Technology* (London: MIT Press, 1991).

William O'Dea, The Social History of Lighting (New York: Macmillan Co., 1958).

Salatino [90].

<sup>94</sup> Juliette James, *Palaces and Courts of the Exposition* (San Francisco: Blair Murdock Co., 1915).

Jill Mulholland, *Architectural Illumination at the World's Fairs*, 1889-1939 (Unpublished Manuscript, University of Oregon, 1993).

Jill Mulholland, "By the Century's Early Light" *Lighting Design and Application* (November 2000) p. 50-54.

Mulholland [82].

Postcard Collection of Jill Mulholland.

Louis Christian Mullgardt, *The Architecture and Landscape Gardening of the Exposition* (San Francisco: Paul Elder and Co., 1915).

North American Press Association, *San Francisco Standard Guide* (San Francisco: North American Press Association, 1915).

Nye [93].

Panama Pacific International Exposition Co., *Official Guide of the Panama Pacific Exposition*, 1915 (San Francisco: The Walgreen Co., 1915).

Panama Pacific International Exposition Co., *Panama Pacific International Exposition Book Number 1, Second Edition* (San Francisco: Panama Pacific International Exposition Co., 1915).

San Francisco Golden Gate International Exposition Co., *Official Guide Book* (San Francisco: San Francisco Golden Gate International Exposition Co., 1939).

San Francisco Panama Pacific International Exposition Co., *Condensed Facts Concerning the Panama Pacific International Exposition* (San Francisco: The Wahlgreen Co., 1915).

San Francisco Panama Pacific International Exposition Co., *Panama Pacific International Exposition Pictures*, 1915-1916 (San Francisco: San Francisco Panama International Exposition Co., 1916).

San Francisco Panama Pacific International Exposition Co., *Red Book of Views of the Panama Pacific International Exposition*, 1915, San Francisco, California (San Francisco: The Wahlgreen Co., 1915).

Louis J. Stellman, *That Was a Dream Worth Building* (San Francisco: H.S. Crocker Co., 1916).

Frank Morton Todd, The Story of the Exposition (London: G.P. Putnams Sons, 1921).

Arthur A. Willoughby, "Illumination Features at the Panama Pacific International Exposition" *Electrical Review/Western Electrician* (Jan-June 1915) p. 560-581.

<sup>95</sup> Joachim Fest, *Speer* (New York: Harcourt Inc., 1998).

Gitta Sereny, Albert Speer: His Battle with Truth (New York: Vintage Books, 1995).

Albert Speer, Inside the Third Reich (Toronto: Macmillan Company, 1970).

Albert Speer, Spandau: The Secret Diaries (Toronto: Macmillan Company, 1974).

<sup>96</sup> Motoko Ishii, *Light to Infinity* (Tokyo: Libroport Co. Ltd., 1991).

Motoko Ishii, Creation of Lightscape (Tokyo: Libroport Co. Ltd., 1997).

Motoko Ishii, Lighting Horizons (Tokyo: Rikuyosha Co. Ltd., 2001).

<sup>97</sup> www.themodern.org/dan-flavin-press2005.html.

<sup>98</sup> Bageb [66].

Serpentine Gallery. "Dan Flavin" Sculpture V. 21, no. 6, (2002) p. 67-70.

DIA Center for the Arts "Dan Flavin Art Institute" Bridgehampton, New York (1995-2000).

Grace Glueck, "Painting Exuberant Forms with a Palette of Light" *New York Times* (March 1, 2002) Section A19

Patricia C. Johnson, "Painted Air," Houston Chronicle (March 13, 2005) p. 8-9.

Simon Crompton, "Light Fantastic," The London Times (Feb. 4, 2006) p. 12.

Tiffany Bell, "Dan Flavin, Posthumously," Art in America (October 2000) p. 4-8.

Michael Rush, "Transparent Scenarios," Art in America (October 2000) p. 22-24.

Daphne Beal, "The Chinati Foundation: A Museum in Process," *Art in America* (October 2000) p. 116-124.

Larry A. Doll, "Architects + Artists" Texas Architect (November 2002) p. 20-27.

<sup>99</sup> Crompton [98].

<sup>100</sup> Crompton [98].

<sup>101</sup> Crompton [98].

<sup>102</sup> Crompton [98].

<sup>103</sup> Crompton [98].

<sup>104</sup> Crompton [98].

<sup>105</sup> Geraldine Baum, "Saffron Spices Up a Cold Central Park: Thousands Come Out of Season to See 'The Gates' by Christo and Jeanne-Claude," Los Angeles, *The Nation* (February 13, 2005) Section A29.

<sup>106</sup> Tuttle [12].

- <sup>107</sup> Baum [105].
- <sup>108</sup> Baum [105].
- <sup>109</sup> Baum [105].
- <sup>110</sup> Baum [105].
- <sup>111</sup> Baum [105].
- <sup>112</sup> Baum [105].
- <sup>113</sup> Baum [105].
- <sup>114</sup> Gopnik [14].
- <sup>115</sup> Gopnik [14].
- <sup>116</sup> Gopnik [14].
- <sup>117</sup> Goldsworthy 1994 [64].
- Goldsworthy 2000 [64].
- <sup>118</sup> Holt [64].
- Shapiro [64].

<sup>119</sup> Annegret Grosskopf, "Walter De Maria," *Stern Magazine* (July 24, 1980) p. 6 -10.

Martin Hogue, "The Sites Project: Lessons from Land Art and Concept Art," *Journal of Architectural Education* V57 No. 3 (February 2004) p 13-21.

<sup>120</sup> Stanley Cavell, "Observations on Art and Science" *Journal of the American Academy* of Arts and Science V.115 No. 3 (1986) p. 39-53.

Harry M. Collins, "The TEA Set: Tacit Knowledge and Scientific Networks," *Science Studies* V4 (1974) p. 165-186.

Paul Crowther, "Cultural Exclusion, Normatively and the Definition of Art" *Journal of Aesthetics and Art Criticism* (Spring 2003) p. 79-85.

Hogue [119].

Latour [67].

Lee [64].

Leo Marx, *The Machine in the Garden: Technology and the Pastoral Idea in America* (London: Oxford University Press, 1964).

Maloney [65].

Charlotte Roth "Afterimage: Drawing Through Process: The Museum of Contemporary Art" New Art Examiner Magazine V27, No. 3 (1999) p. 1-50.

Donald Mackenzie and Judy Wajcman, *The Social Shaping of Technology* (Milton Keynes, UK: Open University Press, 1985).

Harriet Senie, *Contemporary Public Sculpture* (New York: Oxford University Press, 1992).

Harriet Senie, *Dancing in the Landscape: The Sculpture of Athena Tacha* (New York: Grayson Publishing, 2000).

Stiles and Selz [65].

Sudenburg [64].

Reiss [64].

<sup>121</sup> Cavell [120].

Collins [120].

Hogue [119].

Latour 1986 [67].

Lee [4].

Maloney [65].

Reed [120].

Reiss [64].

Roth [120].

Stiles and Selz [65].

Sudenburg [64].

<sup>122</sup> Cavell [120].

Collins [120].

Hogue [119].

Latour 1986 [67].

Lee [4].

Maloney [120].

Reed [120].

Reiss [64].

Roth [120].

Stiles and Selz [65].

Sudenburg [64].

<sup>123</sup> Cavell [120].

Collins [120].

Hogue [119].

Latour, 1986 [67].

Lee [4].

Maloney [120].

Reed [120].

Reiss [64].

Roth [120].

Stiles and Selz [65].

<sup>124</sup> Cavell [120].

Collins [120].

Hogue [119].

Latour, 1986 [67].

Lee [4].

Maloney [120].

Reed [120].

Reiss [64].

Roth [120].

Stiles and Selz [65].

Sudenburg [64]

<sup>125</sup> Cavell [120].

Collins [120].

Hogue [119].

Latour, 1986 [67]. Lee [4].

Maloney [120].

Reed [120].

Reiss [64].

Roth [120].

Stiles + Selz [65].

Sudenburg [64].

<sup>126</sup> Helen A. Cooper, *Eva Hesse* (New Haven: Yale University Art Gallery, 1992).

Lucy R. Lippard, Eva Hesse (New York: New York University Press, 1976).

Stiles and Selz [65].

Elizabeth Sussman, Eva Hesse (New Haven: Yale University Press, 2002).

<sup>127</sup> Stiles and Selz [65].

<sup>128</sup> Stiles and Selz [65].

<sup>129</sup> Bijker [67].

Cavell [120].

Shlain [67].

Bijker 1987 [96].

Collins [120].

Kathryn Henderson, On Line and on Paper: Visual Representations, Visual Culture, and Computer Graphics in Design Engineering (Cambridge: MIT Press, 1999).

Latour [67].

Mackenzie [120].

Marx [64].

Snow [67].

<sup>130</sup> Jones and Galison [67].

Stiles and Selz [65].

Shlain [67].

<sup>131</sup> Latour [67].

<sup>132</sup> Svetlana Alpers, "The Studio, the Laboratory, and the Vexations of Art." *Picturing Art, Producing Science* (London: Routledge, 1998).

<sup>133</sup> Simon Schaffer, "On Astronomical Drawing," *Picturing Art, Producing Sciences* (London: Rutledge, 1998).

<sup>134</sup> Marga Bijvoet, Art as Inquiry (New York: Peter Lang, 1997).

<sup>135</sup> Bijvoet [134].

<sup>136</sup> Bijvoet [134].

<sup>137</sup> Bijvoet [134].

<sup>138</sup> Vincent Pierbone and David Gruber, *A Glow in the Dark* (Cambridge: MA Harvard College, 2005).

<sup>139</sup> Bruno Latour, "How to Be Iconophilic in Art, Science, and Religion" *Picturing Art, Producing Science* (London: Routledge, 1998).

<sup>140</sup> Stiles and Selz [65].

<sup>141</sup> Latour [139].

<sup>142</sup> Harriet Senie, *The Tilted Arc Controversy*. (Minneapolis: University of Minnesota Press, 2002).

<sup>143</sup> Londa Schiebinger, "Lost Knowledge, Bodies of Ignorance, and the Poverty of Taxonomy as Illustrated by the Curios Fate of Flos Pavonis, an Abortifacient," *Picturing Art, Producing Science* (London: Rutledge, 1998).

<sup>144</sup> David Freeburg, "Iconography Between the History of Art and the History of Science, and the Case of the Urban Bee," *Picturing Art, Producing Science* (London: Rutledge, 1998).

<sup>145</sup> Groat and Wang [59].

<sup>146</sup> Norman K. Denzin, *Interpretive Interactionism* (London: Sage Publications, 2001).

Adrian Holliday, *Doing and Writing Qualitative Research* (London: Sage Publications, 1972).

Catherine Marshall and Gretchen Rossman, *Designing Qualitative Research* (London: Sage Publications, 1999).

<sup>147</sup> Groat and Wang [59].

<sup>148</sup> Louis Brill and Christine Kirsten, "The Art of Burning Man," *Leonardo*, V36 No. 5 (2003) p. 341-369.

<sup>149</sup> Josh Tyrangiel, Ta-Nehisi Coates, Carolina A. Miranda, Michael Brunton, David Lau, and Richard Lacayo, "Food for the Eyes and Ears," *Time Magazine*, September 4, 2006, p. 71-76.

## **GENERAL BIBLIOGRAPHY**

Abbott, Carl. The Great Extravaganza (Portland: Oregon Historical Society, 1981).

Albers, Josef. Glass, Color and Light (New York: Guggenheim Foundation, 1994).

Anderes, Fedand Agtanoff, Anne. Ice Palaces (New York: Abbeville Press, 1975).

Applebaum, Stanley. *The Chicago World's Fair of 1893* (New York: Dover Publications, 1980).

Aulback, Louis F. and Butler, Joe. *The Lower Canyons of the Rio Grande, La Linda to Dryden Crossing, Maps and Notes for River Runners* (Houston: Wilderness Area Map Service, 1993).

Aulback, Louis F. and Gorski, Linda C. *The Upper Canyons of the Rio Grande, Presidio to Terlingua Creek, Including Colorado Canyon and Santa Elena Canyon* (Houston: Wilderness Area Map Service, 2000).

Awbrey, Betty Dooley and Doley, Claude. *Why Stop? A Guide to Texas Historical Roadside Markers* (Lanhan, MD: Lone Star Books, 1978).

Austin, E.L. and Hauser, Odell. *The Sesquicentennial International Exposition* (New York: Arno Press, 1976).

Badger, Reid. The Great American Fair (Chicago: Nelson Hall, 1970).

Baker, T. Lindsay. *Blades in the Sky Windmilling through the Eyes of B.H. "Tex" Burdick* (Lubbock, TX: Texas Tech University Press, 1992).

Benedict, Burton. The Anthropology of World's Fair (London: Scholar Press, 1983).

Bezy, John V. and Sanches, Joseph P. *Pecos: Gateway to Pueblos and Plains the Anthology* (Tucson, AZ: Southwest Parks and Monuments Association, 1988).

Blaugrund, Annette. Paris 1889 (New York: Harry Abrams, 1989).

Braudaway, Douglas. *Del Rio: Queen City of the Rio Grande* (Charleston, SC: Arcadia Publishing, 2000).

Braudaway, Douglas. *Railroads of Western Texas: San Antonio to El Paso* (Charleston, SC.: Arcadia Publishing, 2002).

Buchanan, Kimberly Moore. *Apache Women Warriors* (El Paso, TX: Texas Western Press of the University of Texas at El Paso, 1986).

Buel, J.W. The Magic City (New York: Arno Press, 1974).

Burg, David. *Chicago's White City of 1893* (Lexington: University of Kentucky Press, 1976).

Cady, Francis and Dates, Henry. *Illuminating Engineering* (New York: John Wiley and Sons, 1925).

Cameron, William. *History of the World's Columbian Exposition* (Chicago: Columbia History Company, 1893).

Capra, Fritjof. *The Tao of Physics, An Exploration of the Parallels Between Modern Physics and Eastern Mysticism* (Boston: Shamble Publications, 1975).

Carr, Gerald. *In Speech of the Promised Land: Paintings by Frederic Edwin Church* (Boston: University Press of New England, 1901).

Chadwick, Whitney. *Amazons in the Drawing Room* (Berkeley, CA.: University of California Press, 2000).

Chicago Herald Newspaper. *Photographic Views of the World's Columbian Exposition* (Chicago: Stone, Kassler and Painler, 1893).

Chicago Tribune Newspaper. *Glimpses of the World's Fair 1893* (Chicago: Chicago Tribune, 1893).

Chicago Worlds Columbian Exposition. *Glimpses of the World's Fair* (Chicago: Laird and Lee, 1893).

Conan, Michael. *Landscape Design and the Experience of Motion* (Washington DC: Dumbarton and Oakes Research Library and Collection, 2003).

Corner, James. Taking Measures (New Haven, CT.: Yale University Press, 1996).

Coulthurst, S.L. How to Make Lantern Slides (London: Dawbarn and Ward, 1901)

Cox, James A. A Century of Light (New York: Benjamin Co., 1979).

Crow, Melinda. Rockhounding Texas (Helena, MT: Falcon Publishing, 1994).

Davis, George R. Picturesque World's Fair (Chicago: Conkey Co., 1893).

DeMent, Jack. *Fluorescent Chemicals and Their Applications* (Brooklyn, NY: Chemical Publishing Co., 1989).

Denker, Winnie and Sagen Francoise. *The Eiffel Tower* (Paris: Eiffel Tower Century Co., 1989).

Dolbear, A.E. The Art of Projecting (Boston: Lothrop, Lee & Shepard Co., 1887).

Dunsheath, Percy. A History of Electrical Engineering (London: Faber and Faber, 1962).

Edison Institute. A Guidebook for the Edison Institute Museum (Dearborn, MI: no publisher 1941).

Educational Art Series. *The Parisian Dream City* (St. Louis: N.D. Thompson Publishing, 1893).

Elgar, Dietmar. Donald Judd: Colorist (London: Hatje Cantz Publishers).

Emsley, John. *Nature's Building Blocks an A-Z Guide to the Elements* (Oxford: Oxford University Press, 2001).

Evans, David S. and Mulholland, Derral. *Big and Bright, A History of the MacDonald Observatory* (Austin: University of Texas Press, 1986).

Favier, Jean. L'Architecture Exposition Internationale Paris 1937 (Paris: Alexis Sinjon, 1937).

Fisch, Arline M. *Textile Techniques for Jewelers Textile Artists and Sculptors* (Ashville, NC.: Lark Books, 1996).

Fischer, Pierre C. 70 Common Cacti of the Southwest (Tucson, AZ.: Southwest Parks and Monuments Association, 1989).

Flan, Jack. The Collected Writings (Berkeley: University of California Press, 1996).

Flinn, John J. *Official Guide to the World's Columbian Exposition* (Chicago: The Columbian Guide Co., 1893).

Fontana, Bernard L. *Tarahumara: Where Night is the Day of the Moon* (Tucson: University of Arizona Press, 1997).

Foster, Nancy Haston. *Texas Missions: The Alamo and Other Texas Missions to Remember* (Houston: Lone Star Books, 1995).

Foster, William C. *Spanish Expeditions into Texas 1989-1768* (Austin: University of Texas Press, 1995).

France. *The French Pavilion at the New York World's Fair 1939* (Paris: no publisher, 1939).

Gage, Simon Henry and Gage, Henry Phelps. *Optic Projection* (Ithaca, NY: Comstock Publishing, 1914).

General Electric. A Catalogue of the General Electric Photographic Archives (Schenectady, NY: Hall of History Foundation, no date).

General Electric. *Theatre Lighting* (Cleveland, OH: NELA Park Engineering. Department, 1938)

Gillette, J. Michael. Designing with Light (New York: Mayfield Publishing Co., 1978).

Gleason, Sterling. Ultraviolet Guide to Minerals, A Complete Working Manual for the Use of Ultraviolet Light in Locating and Recognizing Minerals (New York: D. Van Nostrand Co., 1960).

Goodison, Lucy. Moving Heaven and Earth (London: Pandora, 1982).

Greenlaugh, Paul. Ephemeral Vistas (London: Manchester University Press, 1988).

Hall, Edward Hagaman. *The Hudson Fulton Celebration 1909* (Albany, NY: J. B. Lyon Company, 1910).

Hals Lighting Division. The Language of Lighting (Chicago: McGraw Edison, 1983).

Harris, Joseph. *The Tallest Tower Eiffel and the Belle Epoque* (Washington DC: Regenery Gateway, 1975).

Hickey, Dave. Air Guitar (Los Angeles: Art Issues Press, 1993).

Hollander, Harry B. *Plastics for the Artists and Craftsman* (New York: Watson-Guptill Publications, 1972).

Honston, Edwin J. and Kennelly, A.E. *Electric and Incandescent Lighting* (New York: W.J. Johnston Co., 1896).

Hugill, Peter J. World Trade Since 1431: Geography, Technology, and Capitalism (Baltimore: Johns Hopkins University Press, 1993).

Ishii, Motoko Light to Infinity (Tokyo: Libroport Co. Ltd., 1991).

Ives, Halsey C. *The Dream City, a Portfolio of Photographic Views* (St. Louis: N.D. Thompson Co., 1893).

Jackson, J.B. The Necessity for Ruins (Boston: University of Mass. Press, 1980).

James, Jack and Weller, Earle. *Treasure Island: The Magic City* (San Francisco: Pisani Printing, 1915).

James, Juliette. *Palaces and Courts of the Exposition* (San Francisco: Blair Murdock Co., 1915).

James, Thurston. *The Prop Builders Molding and Casting Handbook* (White Hall, VA: Betterway Publications, 1989).

Johnson, Raoul Fenton. U.S. and British Patents for Scenic and Lighting Devices for the Theatre from 1861 to 1915 (Urbana: University of Illinois, 1966).

Johnston, Sean F. A History of Light and Color Measurement, Science in the Shadows (Philadelphia: Institute of Physics Publishing, 2001).

Julian, Philippi. The Triumph of Art Nouveau (New York: Larousse and Co., 1974).

Justice, Glenn. Little Known History of the Texas Big Bend Documented Chronicles from Cabeza de Vaca to the Era of Pancho Villa (Odessa, TX: Rimrock Press, 2001).

Kaempffert, Waldemar. *Ornamental Street Lighting* (New York: National Electric Association, 1925).

Keating, Paul W. Lamps for a Brighter America (New York: McGraw Hill, 1954).

Kelley, J. Charles. *Jumano and Patarabueye Relations at La Junta de los Rios* (Ann Arbor: University of Michigan Museum of Anthropology, 1986).

Klein, H. Arthur. Masers and Lasers (New York: J.B. Lippencott Company, 1963).

Koller, Lewis R. Ultraviolet Radiation (New York: John Wiley and Sons, 1952).

Krachenbuel, John O. Electric Illumination (New York: John Wiley and Sons, 1942).

Lacy, Suzanne. Mapping the Terrain (Seattle, WA: Bay Press, 1995).

Lemoine, Bertrand and Rivoirand, D. *Paris 1937* (Paris: Institute Fraincais d' Architecture: Paris-Musees, 1987).

Levin, Miriam R. *When the Eiffel Tower Was New* (New Haven, CT: Eastern Press, 1990).

Lippard, Lucy R. Pink Glass Swan (New York: New Press, 1995).

Lippard, Lucy and Ed Hill. *Manual: Errant Arcadias* (Houston: International Center for Photography Houston Artists Fund, 2002).

Little Dog, Pat. *Border Healing Woman, The Story of Jewel Babb* (Austin: University of Texas Press, 1985).

Lovejoy, Earl M.P. *El Paso's Geologic Past* (El Paso, TX: Texas Western Press of the University of Texas at El Paso, 1996).

Loyerette, Henri. Gustave Eiffel (New York: Rizzoli, 1985).

Luckhurst, Kenneth. The Story of Exhibitions (New York: Studio Public, 1951).

Mandell, Richard. Paris 1900 (Canada: University of Toronto Press, 1967).

Martin, T. Commerford and Coles, Stephen. *The Story of Electricity Volume 2* (New York: M.M. March, 1922).

Mason, Herbert Molloy Jr. Missions of Texas (Birmingham, AL: Oxmoor House, 1974).

Mauldin, John H. *Light, Lasers and Optics* (Blue Ridge Summit, PA: TAB Books Inc., 1988).

Maxwell, Ross A. *The Big Bend of the Rio Grande, A Guide to the Rocks, Landscape, Geologic History, and Settlers of the Area of Big Bend National Park* (Austin: The University of Texas at Austin, 1968).

Maxwell, Ross A. *Big Bend Country, A History of Big Bend National Park* (Big Bend National Park, TX: Big Bend History Association, 1985).

Miles, Elton Ragsdale. *Tales of the Big Bend* (College Station: Texas A&M University Press, 1976).

Minister de la Culture des Musees Nationaux. *1889 La Tour Eiffel et L,Expostion Universaille* (Paris: Musee Nationaux, 1989).

Minnaert, M. Light and Color in the Open Air (New York: Dover Publications, 1954).

Moorhead, Max L. *The Presidio: Bastion of the Spanish Borderlands* (Norman: University of Oklahoma Press, 1975).

Myerson, Jeremy and Sylvia, Katy. *Lamps and Lighting* (London: Conrad Octopus Ltd., 1990).

Nash, Roderick. *Wilderness and the American Mind* (New Haven: Yale University Press, 1973).

National X-ray Reflector Co. *Illumination from Concealed Sources* (New York: National X-ray Reflector Co., 1914).

Nelson, Kerri. A Road Guide to the Geology of Big Bend National Park (Windsor, CO: Paragon Press, 1992).

Netherlands. *The Netherlands Participation at the New York World's Fair 1939* (Holland: William Delft, 1939).

Neuhaus, Eugene. *The Art of Treasure Island* (Berkeley: University of California Press, 1939).

Neumann, Dietrich. Architecture of the Night (New York: Prestel, 2002).

Newcomb, W.W. Jr. *The Indians of Texas from Prehistoric to Modern Times* (Austin: University of Texas Press, 1999).

Newcomb, W.W. Jr. *The Rock Art of Texas Indians* (Austin: University of Texas Press, 1967).

Nye, J.F. *Natural Focusing and Fine Structure of Light, Caustics and Wave Disturbances* (Philadelphia: Institute of Physics Publishing, 1999).

Odom, Susan. *The Grand Old Lady of Presidio County, An Architectural and Historical Narrative* (Austin, TX: Nortex Press, 2001).

Ogle, Kenneth N. Optics (Springfield, IL: Charles C. Thomas, 1961).

Parker, Oren W. and Wolf, Craig R. *Stage Lighting* (New York: Holt, Rinehart and Winston, 1987).

Pecktal, Lynn. *Designing and Painting for the Theatre* (New York: Holt, Rinehart and Winston, 1985).

Portland Lewis and Clark Exposition Co. *The Lewis and Clark Centennial Exposition Illustrated* (Portland, OR: Robert Reid, 1905).

Portland Lewis and Clark Exposition Co. *The Lewis and Clark Exposition and the Golden West* (Chicago: Laird and Lee, 1905).

Potter, Palmer. *Handbook of the World's Columbian Exposition* (Chicago: Rand McNally and Co., 1893).

Pringsheim, Peter and Vogel, Marcel. *Luminescence of Liquids and Solids and Its Practical Applications* (New York: Interscience Publishers Inc., 1946).

Queens Museum. Dawn of a New Day (New York: NYU Press, 1980).

Radley, J.A. and Grant, Julius. *Fluorescence Analysis in Ultra-Violet Light* (London: Chapman & Hall LTD, 1933).

Ragsdale, Kenneth Baxter. *Quicksilver: Terlingua & the Chisos Mining Company* (College Station: Texas A&M University Press, 1976).

Rand, McNally. The Economizer, Gems of the Fair (Chicago: Rand McNally, 1983).

Rechitt, Helena. Art and Feminism (London: Phaindon, 2001).

Reid, Robert A. *The Greatest of Expositions* (St. Louis: Louisiana Purchase Exhibition Co., 1904).

Remington Typewriter Co. *The Panama Pacific Exposition* (San Francisco: Remington Typewriter Co., 1915).

Robbins, Manuel. *Fluorescence, Gems and Minerals Under Ultraviolet Light* (Phoenix: Geosciences Press, 1983).

Robbins, Manuel. *The Collectors Book of Fluorescent Minerals* (New York: Van Nostrand Reinhold, 1983).

Rosenthal, Jean. Lighting for the Stage (New York: Dover, 1979).

Rydell, Robert W. All the World's Fair (Chicago: University of Chicago Press, 1984).

St. Louis Exposition. The World's Work (New York: Doubleday, Page and Co., 1904).

Savage, Sharon Smith and Mallouf, Robert J. *Rock Art of the Chihuahuan Desert Borderlands* (Alpine, TX: Sul Ross State University Center for Big Bend Studies, 1998).

Selden, Samuel and Selman, Hutton D. *Stage Scenery and Lighting* (New York: Appleton Century Crofts Inc., 1930).

Silverburg, Robert. Light for the World (London: D. Van Nostrand, 1939).

Simkin, L. Fairs Past and Present (New York: Van Nostrand, 1939).

Smithsonian Institute. *The Book of Fairs* (Chicago: American Library Association, 1992).

Spearing, Darwin. *Roadside Geology of Texas* (Missoula, MT: Mountain Press Publishing Company, 1991).

Stair, J.L. The Lighting Book (Chicago: Curtis Lighting Inc., 1927).

Stevens, E.S. *Green Plastics An Introduction to the New Science of Biodegradable Plastics* (Princeton, NJ: Princeton University Press, 2002).

Stewart, Omer C. *Peyote Religion A History* (Norman: University of Oklahoma Press, 1987).

Stillwell, Hattie. My Goose Is Cooked (Alpine, TX: Center for Big Bend Studies, 2004).

Sul Ross State University Press. *The Journal of Big Bend Studies* Volumes 7,10,11,12,14,15,16 17, 18 (1995-2006).

Suter, William Norwood. Handbook of Optics (New York: Macmillan Co., no year).

Teague, David W. *The Southwest in American Literature and Art, The Rise of the Desert Aesthetic* (Tucson: University of Arizona Press, 1997).

Thompson, Silvanus P. Light Visible and Invisible (London: Macmillian, 1910).

Thybony, Scott. *Rock Art of the American Southwest* (Portland, OR: Graphic Arts Center Publishing Company, 1999).

Tiberghien, Gilles. Land Art (New York: Princeton Architectural Press, 1995).

Torres, Luis. San Antonio Missions (Tucson, AZ: Southwest Parks and Monuments Association, 1993).

Turpin, Solveig A. "A Railroad Era Industrial Site in Seminole Canyon State Historical Park" *Texas Parks and Wildlife Department Cultural Resource Program Report*, No. 95-1 (1995)

Turpin, Solveig. *Rock Art and Cultural Processes* (San Antonio, TX: Special Publication 3 Rock Art Foundation Inc., 2002).

Turpin, Solveig A. and Bass, Joel. *The Lewis Canyon Petroglyphs* (San Antonio, TX: The Rock Art Foundation, 1997).

U.S. Commission on the International Exposition of Modern Decorative and Industrial Art. *Report of the Commission* (Washington, DC: 1925).

Vasseleu, Catherine. *Textures of Light Vision and Texture in Irigaray, Levinas and Merleau-Ponty* (London: Rutledge, 1998).

Wagner, Albert F. Experimental Optics (New York: John Wiley and Sons, 1929).

Walton, Ann Thorson. *The Swedish and Finnish Pavilions in the Exposition Universelle in Paris in1900* (Minneapolis: University of Minnesota Press, 1986).

Weiss, Alex. Plastics for Modelers (Kent, UK: Nexus Special Interests Ltd., 1998).

Whittaker, John C. American Flintknappers (Austin: University of Texas Press, 2004).

Wood, Elizabeth A. *Crystals and Light, An Introduction to Crystallography* (New York: Dover Publications, 1964).

World's Columbian Exposition. *The Columbian Exposition 1893* (Chicago: Rand McNally, 1893).

World's Columbian Exposition. *The Columbian Exposition 1893 Album* (Chicago: Rand McNally, 1893).

World's Columbian Exposition. *Photographs of the Worlds Fair* (Chicago: World Columbian Exposition, 1893).

Wright, Lewis. Optical Projection, a Treatise on the Use of the Lantern in Exhibition and Scientific Demonstration (New York: Longmans Green Co., 1901).

Wright, Bill. Portraits from the Desert: Bill Wright's Big Bend (Austin: University of Texas Press, 1998).

Wurts, Richard. *New York World's Fair 1939/1940 in Photos* (New York: Dover Publications, 1977).

Youth's Companion. Worlds Fair Extra (Chicago: 1893).

Zintgraff, Jim and Turpin, Solveig A. *Pecos River Rock Art a Photographic Essay* (San Antonio, TX: Sandy McPherson Publishing Company, 1991).

## APPENDIX

FIGURES 1 – 204



Fig. 1. Shadow: Ordinary. A plain plastic pitcher and metal mesh are made beautiful by light and shadow. (Digital photograph © Jill Mulholland 2006).



Fig. 2. Shadow: Curled. The shadow arcs around the steel cylinder. (Digital photograph @ Jill Mulholland 2006).



Fig. 3. Shadow: Subtle. The black wire is the shadow of a pole. (Digital photograph © Jill Mulholland 2006).

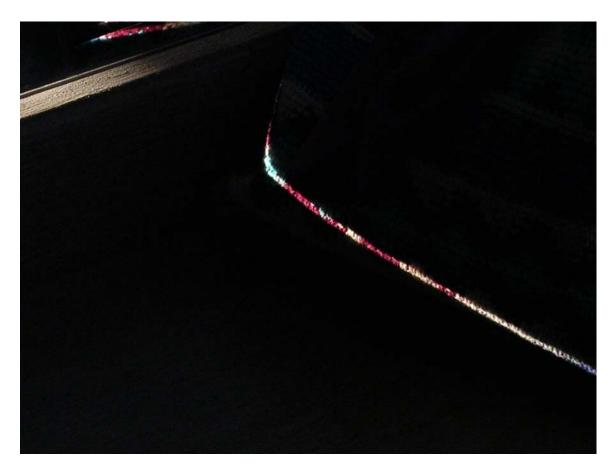


Fig. 4. Shadow: Curved. Light and shadow are curved because of the surface they fall upon. (Digital photograph © Jill Mulholland 2006).



Fig. 5. Shadow: Vertical. The shadow is vertical because we build in 90 and 180 degree angles. (Digital photograph © Jill Mulholland 2006).



Fig. 6. Shadow: Horizontal. The shadows are horizontal we build in 90 and 180 degree angles, and the surface it falls upon. (Digital photograph © Jill Mulholland 2006).



Fig. 7. Shadow: Fuzzy. The light through holes overlaps on the circle edges. (Digital photograph @ Jill Mulholland 2006).



Fig. 8. Shadow: Elongated. The light through holes is stretched and falls on three surfaces. (Digital photograph © Jill Mulholland 2006).

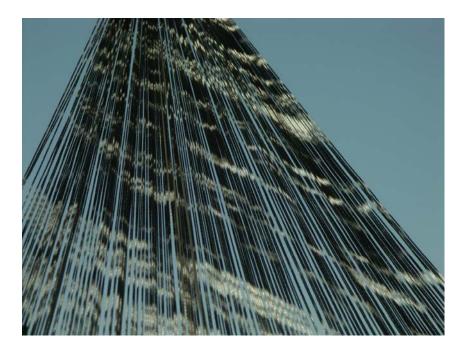


Fig. 9. Shadow: Chopped. Shadow filters through the roof of the ramada and looks fuzzy on the hammock strings. (Digital photograph © Jill Mulholland 2006).



Fig. 10. Shadow: Diagonal. The shadows express the intricate cross bracing of the tower. (Digital photograph © Jill Mulholland 2006).



Fig. 11. Shadow: Discontinued. The shadows tell of a roof in ruins. (Digital photograph © Jill Mulholland 2006).



Fig. 12. Shadow: Bumpy. The curved edge of the shadow indicates bubbles in the roof sheathing. (Digital photograph © Jill Mulholland 2006).

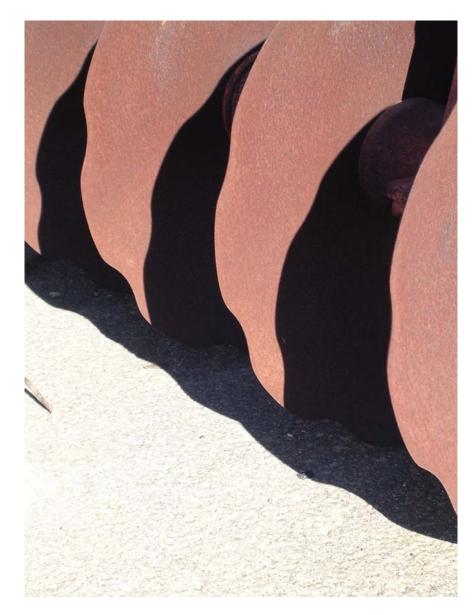


Fig. 13. Shadow: Mirrored. Shadows emphasize the irregular edge of the metal wheels. (Digital photograph © Jill Mulholland 2006).



Fig. 14. Shadow: United. The roof line, wall and tree are united in shadow on the wall, in reality they are far apart. (Digital photograph © Jill Mulholland 2006).



Fig. 15. Shadow: Texture. The light and shadow indicate the wall has texture, that it is not flat. (Digital photograph © Jill Mulholland 2006).



Fig. 16. Shadow: Fat and Stretched. The shadow elongates the size of the rebar. (Digital photograph © Jill Mulholland 2006).



Fig. 17. Shadow: Fat and Pronged. The fat shadows of the wire resemble antelope horns. (Digital photograph © Jill Mulholland 2006).



Fig. 18. Shadow: Fat and Wavy. The shadow of the iron bar dances across the corrugated metal. (Digital photograph © Jill Mulholland 2006).



Fig. 19. Shadow: Collage. The sticks, rope, snake skin and shadow looked arranged but were not. (Digital photograph © Jill Mulholland 2006).



Fig. 20. Shadow: Colors. The corrugated wall panels appear different colors because of the angles of the light and shadow. (Digital photograph © Jill Mulholland 2006).



Fig. 21. Reflection: Glitter. Light reflected off of the tops of the waves in the lake shimmers. (Digital photograph © Jill Mulholland 2006).

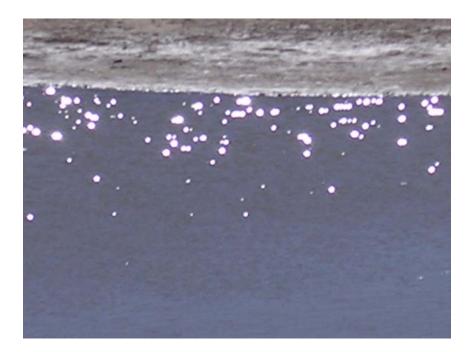


Fig. 22. Reflection: Glitter Detail. The reflected light on water varies depending on the angle viewed and shape of the surface. (Digital photograph © Jill Mulholland 2006).



Fig. 23. Reflection: Multiple. The differently angled window panes make many telephone poles instead of one. (Digital photograph © Jill Mulholland 2006).



Fig. 24. Reflection: Shifting Blue. The blue morpho butterfly wings change color depending on the angle viewed compare with Figs 25 and 26. (Digital photograph © Jill Mulholland 2006).



Fig. 25. Reflection: Shifting Blue and Orange. The blue morpho butterfly wings change color depending on the angle viewed compare with Figs 24 and 26. (Digital photograph © Jill Mulholland 2006).

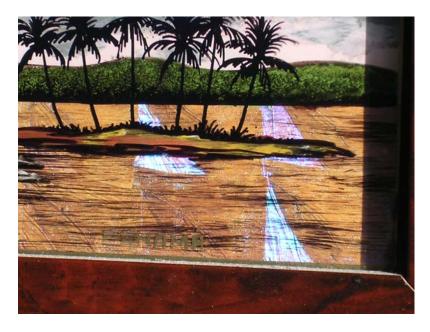


Fig. 26. Reflection: Shifting Orange. The blue morpho butterfly wings change color depending on the angle viewed compare with Figs 24 and 25. (Digital photograph © Jill Mulholland 2006).



Fig. 27. Reflection: Angle on Weeds. The sunlight on the grass tells the direction of the wind. (Digital photograph © Jill Mulholland 2006).



Fig. 28. Reflection: Colored Glitter. The bits of reflective signage fall on different angles and appear different colors. (Digital photograph © Jill Mulholland 2006).



Fig. 29. Reflection and Shadow: Contrast. The very high contrast between light and shadow is visually engaging. (Digital photograph © Jill Mulholland 2006).



Fig. 30. Reflection: Circular. The reflection of the cylindrical soda can is circular projected on the table top. (Digital photograph © Jill Mulholland 2006).



Fig. 31. Reflection: Flash. The undersides of the beams were illuminated for a few minutes. (Digital photograph © Jill Mulholland 2006).



Fig. 32. Reflection: Orange. The color of the wavy line tells that it is sunset. (Digital photograph © Jill Mulholland 2006).



Fig. 33. Reflection: Relaxing. The strong, white Texas sun is compared to the more restful blue line of light. (Digital photograph © Jill Mulholland 2006).



Fig. 34. Reflection: Illusion. The rainbow appears to go through the door, when it is reflected form the floor. (Digital photograph © Jill Mulholland 2006).



Fig. 35. Reflection: Squiggly. The reflections from the tinsel shake and shimmer. (Digital photograph © Jill Mulholland 2006).



Fig. 36. Reflection Windows: Small. Reflections from glass form patterns on the concrete. (Digital photograph © Jill Mulholland 2006).



Fig. 37. Reflection Windows: Large. The reflections of the windows project onto a neighboring building. (Digital photograph © Jill Mulholland 2006).



Fig. 38. Reflection Windows: Five Stories. Reflections are projected across the street on three buildings. (Digital photograph © Jill Mulholland 2006).



Fig. 39. Reflection Windows: Japanese Calligraphy. The shapes of the reflections resemble Japanese. (Digital photograph © Jill Mulholland 2006).



Fig. 40. Reflection with Shadow: Street Light. The shadow should not have the reflection in the middle of it. (Digital photograph © Jill Mulholland 2006).



Fig. 41. Reflection with Shadow: Railing. The shadow is combined with lighter reflections running through. (Digital photograph © Jill Mulholland 2006).



Fig. 42. Reflection: Depth. The mesh cage looks twice its actual size. (Digital photograph © Jill Mulholland 2006).



Fig. 43. Reflection: Flat. Compare to depth of glow inFig. 44. (Digital photograph © Jill Mulholland 2006).



Fig. 44. Glow: Enticing. Compare toFig. 43, the glass is alluring through the depth of glow and resulting beauty. (Digital photograph © Jill Mulholland 2006).



Fig. 45. Glow: Enlarging. The tiny glass spheres reflect and magnify light back. (Digital photograph © Jill Mulholland 2006).

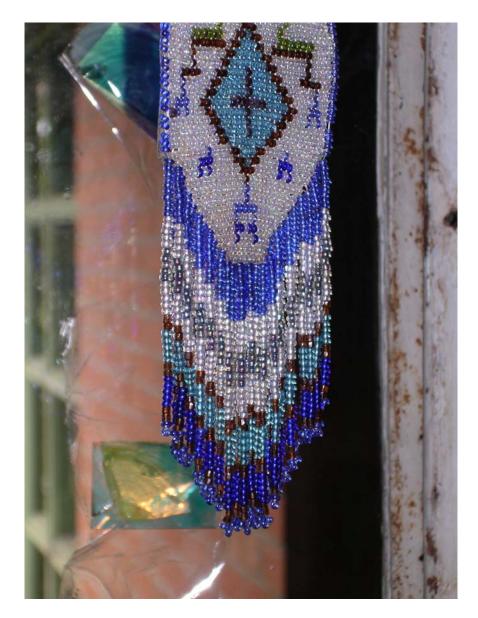


Fig. 46. Reflection: Flat. The beads reflect light, compare with Figs. 47 and 48. (Digital photograph © Jill Mulholland 2006).



Fig. 47. Glow: Inviting. The beads glow, compare with Figs. 46 and 48. (Digital photograph @ Jill Mulholland 2006).

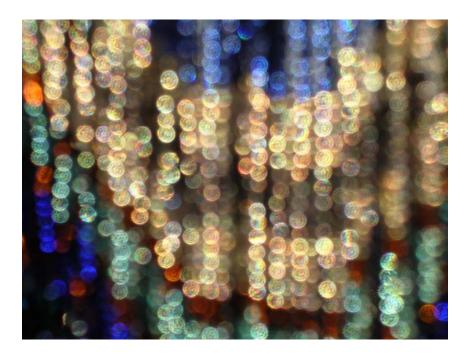


Fig. 48. Glow: Mesmerizing. Close up of the glowing beads, compare with Figs. 46 and 47. (Digital photograph © Jill Mulholland 2006).



Fig. 49. Color: Translucent. Flowers glow on cloudy days. (Digital photograph © Jill Mulholland 2006).



Fig. 50. Color: Pulsating. Flowers glow as the sun goes down. (Digital photograph © Jill Mulholland 2006).

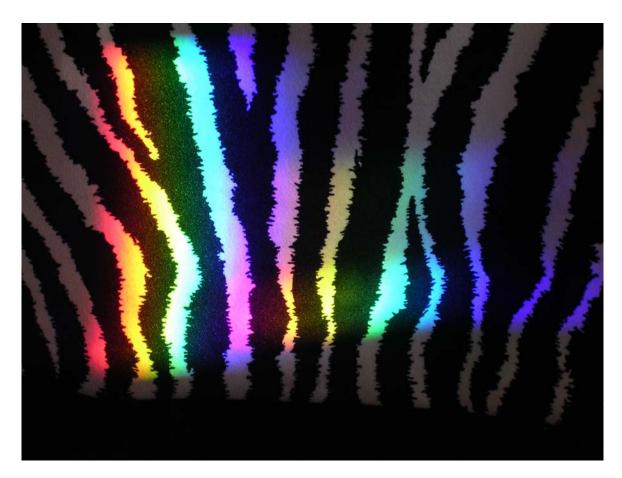


Fig. 51. Color: White. The colors are more strongly reflected in the white fabric. (Digital photograph © Jill Mulholland 2006).



Fig. 52. Color: The Chihuahua Desert. The colors of the desert are reflected in the plastic. (Digital photograph © Jill Mulholland 2006).

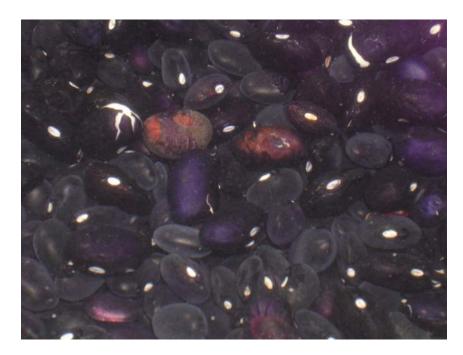


Fig. 53. Color: Black. Beans aren't black in West Texas. (Digital photograph © Jill Mulholland 2006).



Fig. 54. Color: Intensity. Rust and color are more intense on an overcast day, the sun washes out color. (Digital photograph © Jill Mulholland 2006).



Fig. 55. The History of Lighting Design: The Vatican. The Vatican illuminated by candles for a festival in 1547. (Neumann; page 9).

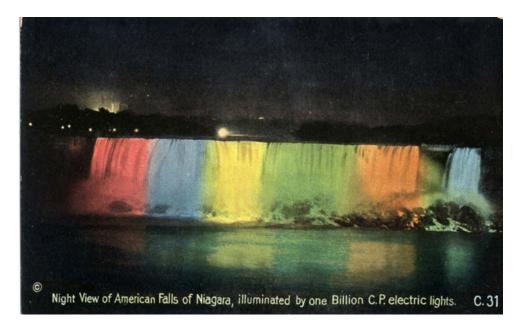


Fig. 56. The History of Lighting Design: Niagara Falls. Lighting by Walter D'Arcy Ryan. (Postcard from author's collection).

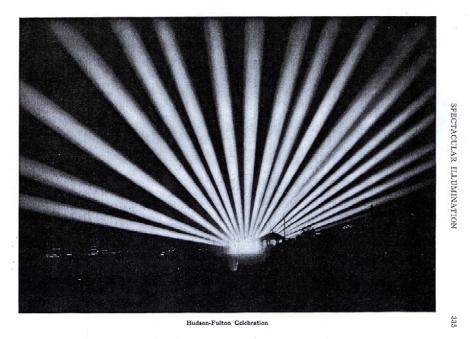


Fig. 57. The History of Lighting Design: First Rainbow Scintillator. The first public exhibit of the Scintillator seen in later celebrations, by Ryan. (Hall; page 585).

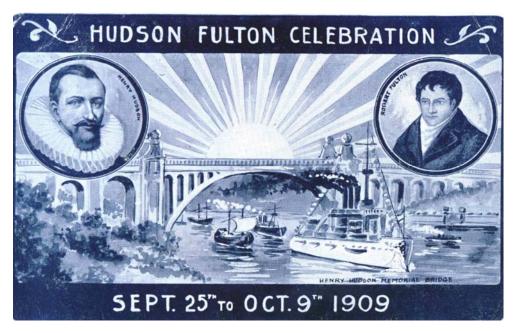


Fig. 58. The History of Lighting Design: The Hudson Fulton Celebration. Note fan shape in the background is the rainbow scintillator fromFig. 57. (Postcard from author's collection).



Fig. 59. The History of Lighting Design: Buffalo. Electricity Building illuminated by Ryan. (Postcard from author's collection).

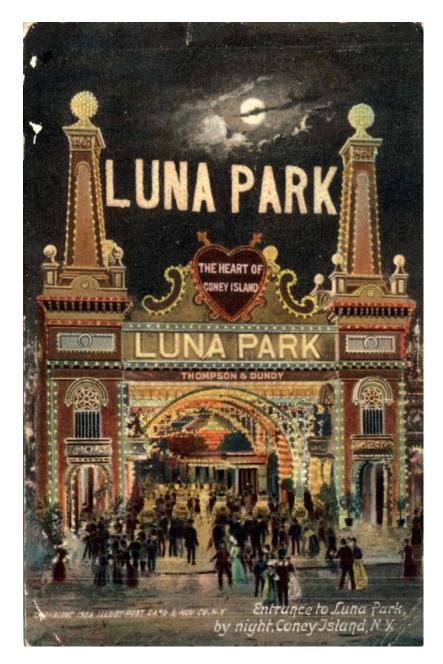


Fig. 60. The History of Lighting Design: Luna Park, Coney Island. Amusement Park illumination between 1900 and 1910. (Postcard from author's collection).



Fig. 61. The History of Lighting Design: Asbury Park, NJ. The casino demonstrates lines of incandescent lights the earliest style of architectural illumination. (Digital photograph © Jill Mulholland 2006).



Fig. 62. The History of Lighting Design: The 1915 Panama Pacific International Exhibition (PPIE), San Francisco, by Ryan. Note rainbow scintillator, the fan shape on the left, and the lights hidden on the roof to illuminate the tower. (Postcard from author's collection.)

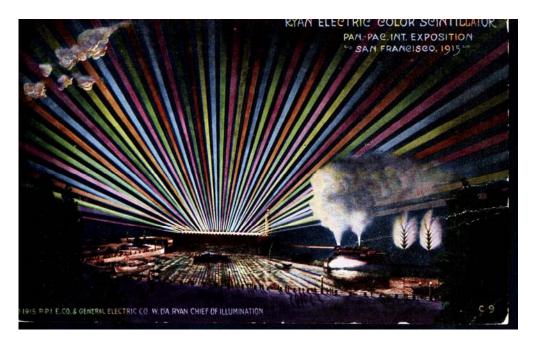


Fig. 63. The History of Lighting Design: The Rainbow Scintillator PPIE. Fortyeight, 36" diameter searchlights, manned by a battery of Marines who changed the colors and angles. A steam engine is shown on the lower right to provide a surface for the light to reflect upon. (Postcard from author's collection).

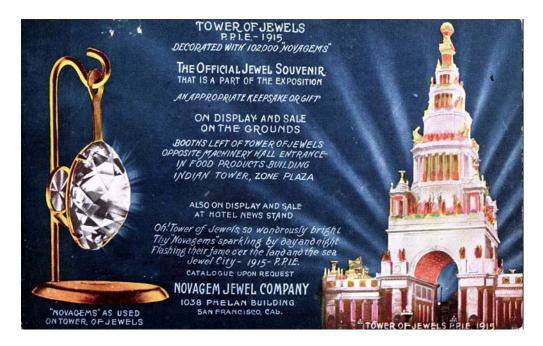


Fig. 64. The History of Lighting Design: The Tower of Jewels, PPIE. Lead cut crystals were imported from Austria in five colors to provide a shimmer effect on the Tower. (Postcard from author's collection).



Fig. 65. The History of Lighting Design: The 1934 Century of Progress World's Fair, Chicago, by Ryan. Note the crossing searchlights on the red/orange Electricity Building. (Postcard from author's collection).



Fig. 66. The History of Lighting Design: Night Battle, World War II. War is possible at night because of searchlights. (Postcard from author's collection).



Fig. 67. The History of Lighting Design: Speer and Hitler, 1936 Paris World's Fair, German Pavilion. The lighting portrays Germany's rising power. (Postcard from author's collection).

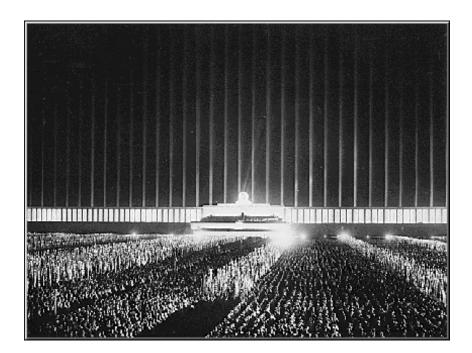


Fig. 68. The History of Lighting Design: Speer and Hitler, 1937 Nurenburg Rally. Speer used every available searchlight in the country for this, "Cathedral of Light". (http://www.skylighters.org/mainmenu.html).



Fig. 69. The History of Lighting Design: Speer and Hitler, 1938 Berlin Streets for a Mussolini Visit. (Postcard from author's collection).



Fig. 70. Contemporary Light and Art: Patriotism and Memorial. The Empire State Building is red, white and blue, Twin Towers are represented in light in the background, commemorating 9- 11. (http://www.skylighters.org/mainmenu.html).



Fig. 71. Contemporary Light and Art: The Gates by Christo and Jeanne Claude, Central Park, New York City, 2005. The translucent fabric, illuminated by the sun, becomes a canvas for the branch shadows. (http://www.allcalenddars.net).



Fig. 72. Contemporary Light and Art: Sacred Projections, by Ishii. The Japanese figures are projected to honor a nearby shrine. Please note the car taillights in red at the base of the hill to for scale. (Ishii 1991; page 169.)



Fig. 73. Contemporary Light and Art: Water as Projection Surface, by Ishii. An amusement park ride at the Osaka World's Fair, 1970. (Ishii 1991; page 193)



Fig. 74. Contemporary Light and Art: by Flavin, Marfa Texas. Note color mixing of the blue and green light on the wall. (Digital photograph © Jill Mulholland 2006).

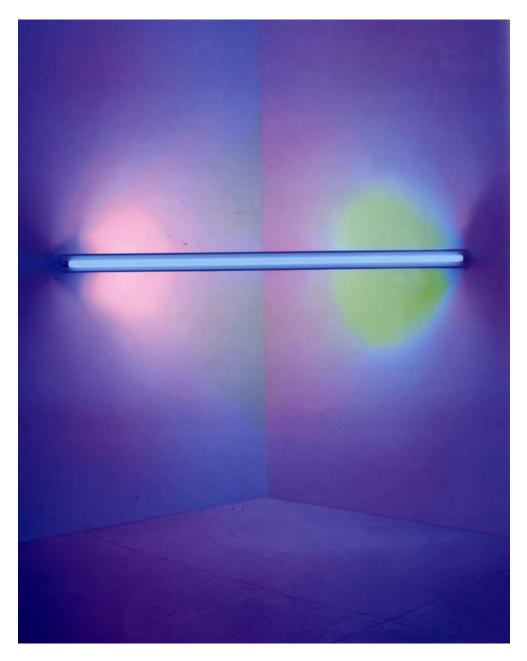


Fig. 75. Contemporary Light and Art: by Flavin. Colored fluorescent lights mix colors on the walls. (Govan page 78).



Fig. 76. Dissertation Project Area: the Big Bend section of West Texas. Note proximity to Mexico. (http://www.mapquest.com/).



Fig. 77. Dissertation Project Area: Topography. The project is located center bottom of card, where the Rocky Mountains meet the black border. Where the border turns NE the "Big Bend" of the Rio Grande River (Postcard from author's collection).

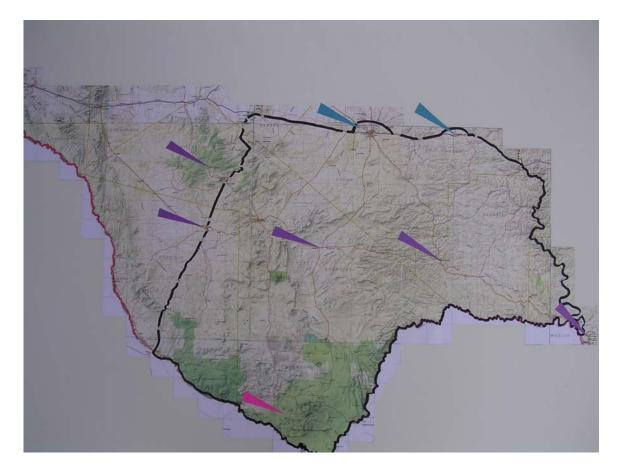


Fig. 78. Dissertation Project Area: Boundaries. The black border delineates the project area in West Texas. The pink arrow at the bottom is the location of the Chimneys in Big Bend National Park. The purple arrow to the far right is Seminole Canyon State Park. The line of purple arrows from east to west, are the train tracks and Highway 90. The purple arrow above this line is the location of the McDonald Observatory. The blue arrows at the top are Fort Stockton on the left and Bakersfield on the right, connected by Interstate 10. (Texas Atlas pages 51, 52, 63-66, 74, 75)



Fig. 79. Big Bend National Park: Rock Carvings and Incisions. Prehistoric rock art at the Chimneys. (Digital photograph © Jill Mulholland 2006).



Fig. 80. Big Bend National Park: Rock Carvings and Incisions Detail. Not visible without the water. (Digital photograph © Jill Mulholland 2006).



Fig. 81. Big Bend National Park: Chimneys Overview. The carvings in Figs. 79-80 are located on the singular rock on the right. (Digital photograph © Jill Mulholland 2006).



Fig. 82. Big Bend National Park: Goat Mountain, Fall Morning. Compare color to Figs. 83 and 84. (Digital photograph © Jill Mulholland 2006).



Fig. 83. Big Bend National Park: Goat Mountain, Mid Day Spring. Compare color to Figs. 82 and 84. (Digital photograph © Jill Mulholland 2006).



Fig. 84. Big Bend National Park: Goat Mountain, Sunset Winter. Compare color to Figs. 82 and 83. (Digital photograph © Jill Mulholland 2006).



Fig. 85. Big Bend National Park: Potential Signaling Device. It is the rock with the straight top in the center of the image. (Digital photograph © Jill Mulholland 2006).



Fig. 86. Big Bend National Park: Potential Signaling Device Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 87. The Gates by Christo and Jeanne-Claude in Central Park New York City 2005: A Parade of Flags. Overview of Gates marching through the park. (Digital photograph courtesy of © Marsha Stern 2005).



Fig. 88. The Gates by Christo and Jeanne-Claude in Central Park New York City 2005: Color Contrast. The orange fabric and the blue light of winter are color opposites and accentuate snow covered contours of the park. (Digital photograph courtesy of © Marsha Stern 2005).



Fig. 89. The Gates by Christo and Jeanne-Claude in Central Park New York City 2005: Fabric Indicates Wind Movement. The repetition of the forms made the wind direction noticeable. (Digital photograph courtesy of © Marsha Stern 2005).



Fig. 90. The Gates by Christo and Jeanne-Claude in Central Park New York City 2005: Scale to Walk Through and Under. (Digital photograph courtesy of © Marsha Stern 2005).



Fig. 91. Andy Goldsworthy: Leaves. Gathered on site, sorted and rearranged around the high contrast of the dark hole, we see the color of the leaves in a new way. (http://www.msubillings.edu/).



Fig. 92. Andy Goldsworthy: Stones. Rocks are arranged to march into the ocean, make us aware of the stones themselves, we see the stones in a new way. (http://www.nacha.dit.ca.free.fr).



Fig. 93. Andy Goldsworthy: Branch Frame. Branches gathered on site, form a frame and make see the site in a new way. (http://www.hainesgallery.com).



Fig. 94. Andy Goldsworthy: Ice Egg. Ice pieces, gathered on site, form an egg shape and we see the site in a different way. (http://www.sculpture.org.uk).



Fig. 95 Robert Smithson: Spiral Jetty. The small spiral on the left side of the image is the Spiral Jetty, taken from a satellite, located outside of Salt Lake City. (http://www.spaceimaging.com)

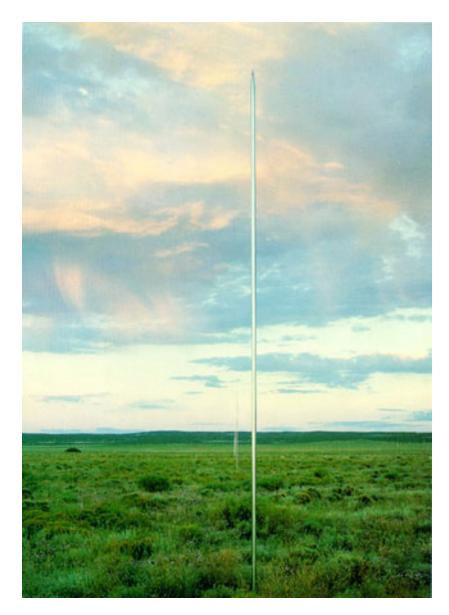


Fig. 96. Walter DeMaria: Lightning Field. Close up of one of 400 stainless steel poles that make up the work. (http://www.lightningfield.org/)



Fig. 97. Glass Tests: Colored Light Reflections. Light is refracted through irregularly shaped glass. (Digital photograph © Jill Mulholland 2006).

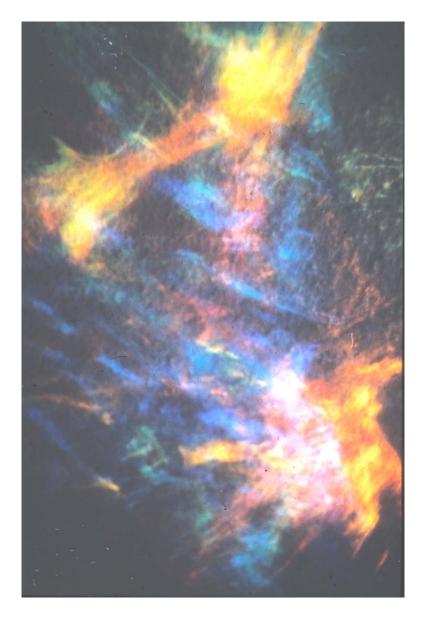


Fig. 98. Glass Tests: Colored Light Reflections Detail. Note blue is calming. (Digital photograph © Jill Mulholland 2006).



Fig. 99. Glass Tests: Light, White and Sandblasted. Note light and shadow differences. (Digital photograph © Jill Mulholland 2006).

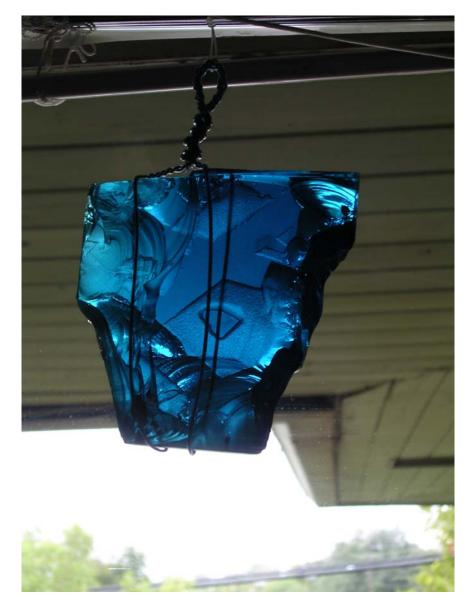


Fig. 100. Glass Tests: Light, Blue, Chipped and Sandblasted. Note light and shadow differences. (Digital photograph © Jill Mulholland 2006).



Fig. 101. Glass Tests: Light, White, Engraved and Weathered. Note the light and shadow differences. (Digital photograph © Jill Mulholland 2006).



Fig. 102. Glass Tests: Light and Hot Glass Custom Forms. Blown glass forms for light projections that were cut, polished, sandblasted, chipped and arranged for UV ingredients. (Digital photograph © Jill Mulholland 2006).



Fig. 103. Plastic Tests: Light and Dark Stacked Sheets. Note light transmission differences in colors. (Digital photograph © Jill Mulholland 2006).



Fig. 104. Plastic Tests: Light and Stacked Color Mixing Detail. Note how colors mix and form new ones inside the tumblers. (Digital photograph © Jill Mulholland 2006).



Fig. 105. Plastic Tests: Light and Stacked Color Mixing. Note different tumbler forms change color mixing intensities. (Digital photograph © Jill Mulholland 2006).



Fig. 106. Calcite Tests: Light and Texture. Note blue light looks like paint. (Digital photograph © Jill Mulholland 2006).



Fig. 107. Calcite Tests: Light and Geologic Cleavage Planes. The different planes are highlighted by the different colors of light. (Digital photograph © Jill Mulholland 2006).



Fig. 108. UV Tests: Color Mixing Chart. UV paint color mixing charts on black and white surfaces, each square was a different color under UV light. (Digital photograph © Jill Mulholland 2006).



Fig. 109. UV Tests: UV Paint Sample. Color sample changed radically under UV light. (Digital photograph © Jill Mulholland 2006).



Fig. 110. Dichroic Glass Tests: Reflections. Colors move with the changing angle of the sun. (Digital photograph © Jill Mulholland 2006).



Fig. 111. Dichroic Glass Tests: Reflections Blue Detail. Note the calming effect of the color blue. (Digital photograph © Jill Mulholland 2006).

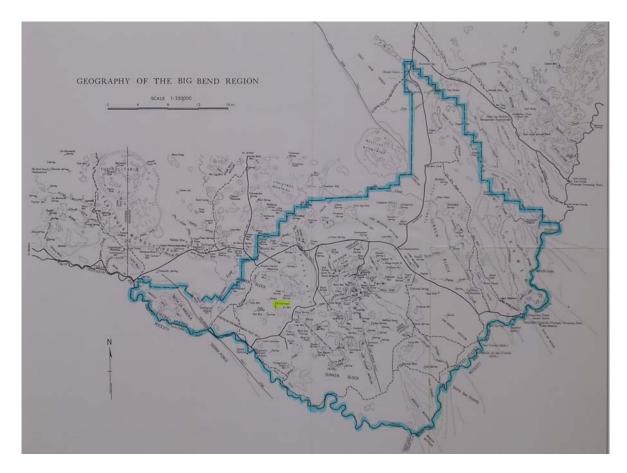


Fig. 112. The Architecture of Colored Light Case Study in Big Bend National Park (BBNP): Map. Case study location at the Chimneys is the yellow highlight in the center left. (Maxwell 1968)



Fig. 113. The Architecture of Colored Light Case Study, BBNP: Scale #1. Note the very small white spot in center. (Digital photograph © Jill Mulholland 2006).



Fig. 114. The Architecture of Colored Light Case Study, BBNP: Scale #2. The white spot fromFig. 113 is the mylar covered rock. (Digital photograph © Jill Mulholland 2006).



Fig. 115. The Architecture of Colored Light Case Study BBNP: Overview. The roof structure between the rock and brown tarp is the installation. Please note Ocotillo located to the right. This is the same ocotillo fromFig. 114. (Digital photograph © Jill Mulholland 2006).



Fig. 116. The Architecture of Colored Light Case Study, BBNP: From Above. (Digital photograph © Jill Mulholland 2006).



Fig. 117. The Architecture of Colored Light Case Study, BBNP: From Front. (Digital photograph © Jill Mulholland 2006).



Fig. 118. The Architecture of Colored Light Case Study, BBNP: Color Testing. (Digital photograph © Jill Mulholland 2006).



Fig. 119. The Architecture of Colored Light Case Study, BBNP: Reflection Color Palette. (Digital photograph © Jill Mulholland 2006).



Fig. 120. The Architecture of Colored Light Case Study, BBNP: Reflection Color Palette Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 121. The Architecture of Colored Light Case Study, BBNP: Geology Color Palette of Burro Mesa. (Digital photograph © Jill Mulholland 2006).



Fig. 122. The Architecture of Colored Light Case Study, BBNP: Geology Color Palette of Castelon Peak. (Digital photograph © Jill Mulholland 2006).



Fig. 123. The Architecture of Colored Light Case Study, BBNP: Tumblers as Geologic Layers. (Digital photograph © Jill Mulholland 2006).



Fig. 124. The Architecture of Colored Light Case Study, BBNP: Roof Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 125. The Architecture of Colored Light Case Study, BBNP: Expansive View. Note Santa Elena Canyon the break in the horizon in the distance. (Digital photograph © Jill Mulholland 2006).



Fig. 126. The Architecture of Colored Light Case Study, BBNP: Reflection Detail. Close up of the reflections made by the roof seen in Figs. 123-125. (Digital photograph © Jill Mulholland 2006).

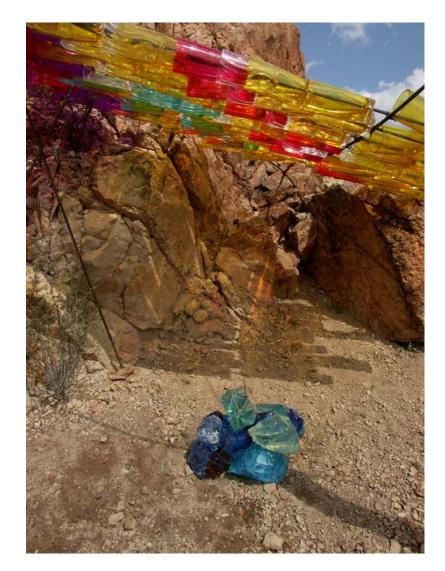


Fig. 127. The Architecture of Colored Light Case Study, BBNP: Reflection Overview. Note colors reflected on rocks in partial sunshine. Blue glass cairn is for introspection. (Digital photograph © Jill Mulholland 2006).



Fig. 128. The Architecture of Colored Light Case Study, BBNP: Introspective View in Blue Glass Cairn. (Digital photograph © Jill Mulholland 2006).



Fig. 129. The Architecture of Colored Light Case Study, Roof of Texas A&M University, (TAMU): Color Palette. Note flat green piece on middle shelf and orange bowls on top shelf. (Digital photograph © Jill Mulholland 2006).



Fig. 130. The Architecture of Colored Light Case Study, TAMU: Sample of Reflection Palette. (Digital photograph © Jill Mulholland 2006).

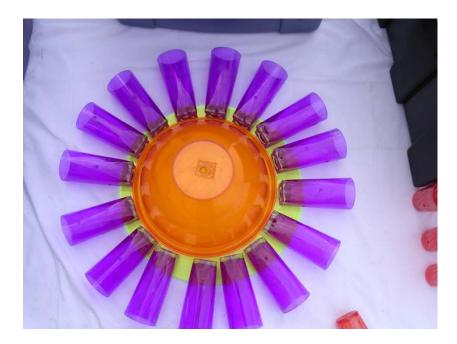


Fig. 131. The Architecture of Colored Light Case Study, TAMU: Reflection Palette Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 132. The Architecture of Colored Light Case Study, TAMU: Final Form. (Digital photograph © Jill Mulholland 2006).



Fig. 133. The Architecture of Colored Light Case Study, TAMU: Connection. The steel bin held the rebar; the colors mixed and glowed from within. (Digital photograph © Jill Mulholland 2006).



Fig. 134. . The Architecture of Colored Light Case Study, TAMU: Connection Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 135. The Architecture of Colored Light Case Study, TAMU, Sky View. Note the flat green piece and orange bowls fromFig. 129. (Digital photograph © Jill Mulholland 2006).



Fig. 136. The Architecture of Colored Light Case Study, TAMU: Reflections. Detail of the colored reflections from the orange bowls and green piece seen in Figs. 129 and 135. (Digital photograph © Jill Mulholland 2006).



Fig. 137. The Architecture of Colored Light Case Study, TAMU: UV Reflections. The light green glowing circle is the flat piece from Figs. 129, 135, and 136. (Video still © Jill Mulholland 2006).



Fig. 138. The Architecture of Colored Light Case Study, TAMU: Glass Cairn for Introspection. Please note large green piece at the far right and the colored green pieces throughout. (Video still © Jill Mulholland 2006).



Fig. 139. The Architecture of Colored Light Case Study, TAMU: Glass Cairn Detail. Close up of the large green piece fromFig. 138. (Video still © Jill Mulholland 2006).



Fig. 140. The Architecture of Colored Light Case Study, TAMU: UV Reflections Glass Cairn. The bright green pieces are the same as seen in Figs. 139 -140. (Video still © Jill Mulholland 2006).



Fig. 141. The Trains/Three Cultures Case Study: The Viewing Frame Is the Space Between the Containers. (Digital photograph © Jill Mulholland 2006).



Fig. 142. The Trains/Three Cultures Case Study: Native American Art #1. Rock art is projected onto the sky and visible above and between the cars. (Video still © Jill Mulholland 2006).



Fig. 143. The Trains/Three Cultures Case Study: Native American Art #2. Rock art is projected onto the sky and visible above and between the cars. (Video still © Jill Mulholland 2006).



Fig. 144. The Trains/Three Cultures Case Study: Hispanic Art in Iron Work. (Video still © Jill Mulholland 2006).



Fig. 145. The Trains/Three Cultures Case Study: Hispanic Architecture. (Video still © Jill Mulholland 2006).

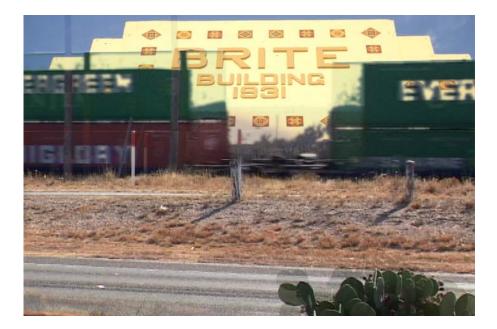


Fig. 146. The Trains/Three Cultures Case Study: Anglo Architecture #1. (Video still © Jill Mulholland 2006).



Fig. 147. The Trains/Three Cultures Case Study: Anglo Architecture #2. (Video still © Jill Mulholland 2006).



Fig. 148. The Wind Case Study: Turbine Overview #1. A large wind farm near McCamey Texas. (Video still © Jill Mulholland 2006).



Fig. 149. The Wind Case Study: Turbine Overview #2. Close up of ten turbines near McCamey Texas. (Video still © Jill Mulholland 2006).



Fig. 150. The Wind Case Study: Turbine Blade Detail Daylight. (Video still © Jill Mulholland 2006).

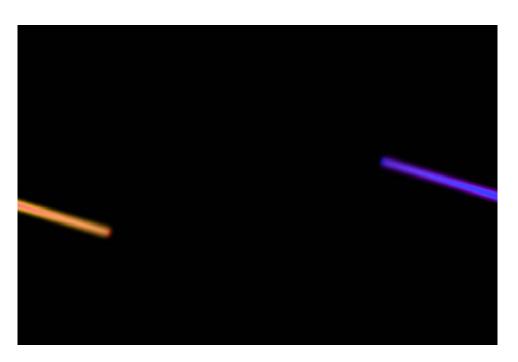


Fig. 151. The Wind Case Study: Turbine Blade Detail Illuminated. (Video still © Jill Mulholland 2006).

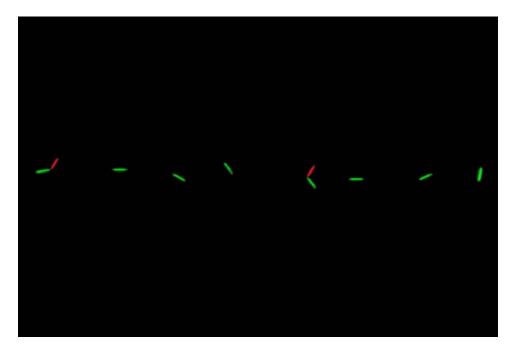


Fig. 152. The Wind Case Study: Turbine Line Illuminated #1. The simulated illumination of one line of eight turbines. (Video still © Jill Mulholland 2006).

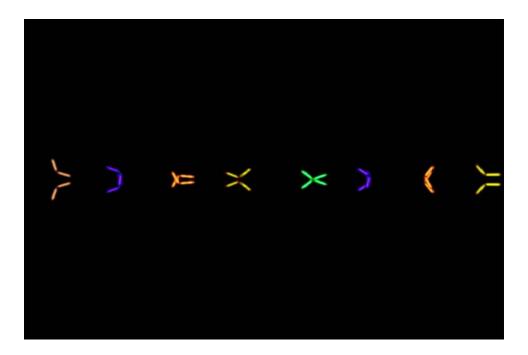


Fig. 153. The Wind Case Study: Turbine Line Illuminated #2. The simulated illumination of two lines of eight turbines. (Video still © Jill Mulholland 2006).

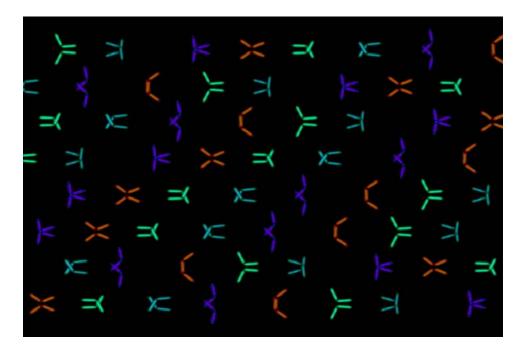


Fig. 154. The Wind Case Study: Turbine Field Illuminated #1. The simulated illumination of many turbines. (Video still © Jill Mulholland 2006).

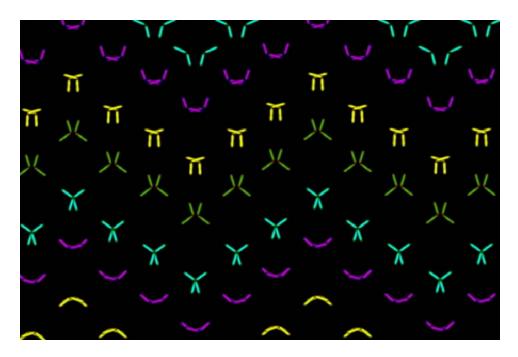


Fig. 155. The Wind Case Study: Turbine Field Illuminated #2. The simulated illumination of many turbines. (Video still © Jill Mulholland 2006).

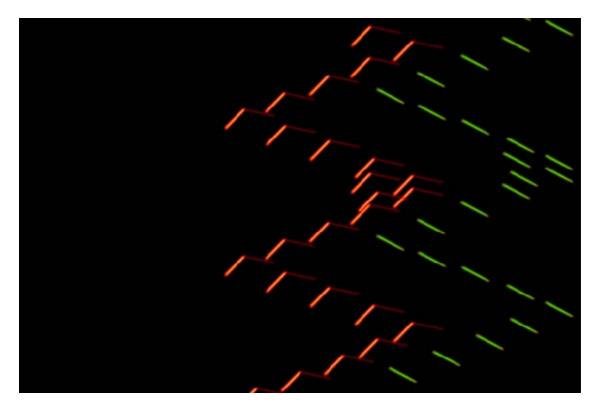


Fig. 156. The Wind Case Study: Turbine Field Illuminated #3. The simulated illumination of many turbines. (Video still © Jill Mulholland 2006).



Fig. 157. The Road Trip Case Study: Road Rhythm Mapping. Determines locations of installations along the road. (Digital photograph © Jill Mulholland 2006).



Fig. 158. The Road Trip Case Study: Riverside Campus Road Underlay of Route. (Digital photograph © Jill Mulholland 2006).

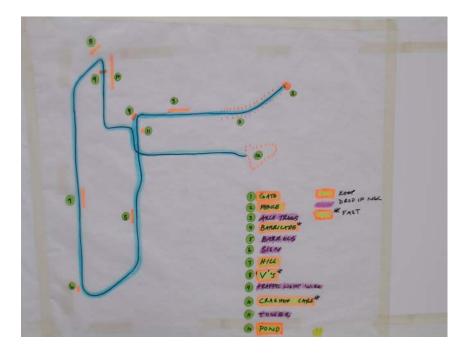


Fig. 159. The Road Trip Case Study: The Route with Installation Locations. (Digital photograph © Jill Mulholland 2006).

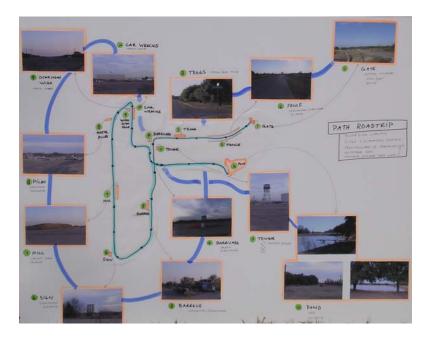


Fig. 160. The Road Trip Case Study: The Route and Location Details. (Digital photograph © Jill Mulholland 2006).



Fig. 161. The Road Trip Case Study: Material Tests, Form, Color and Brightness. (Digital photograph © Jill Mulholland 2006).



Fig. 162. The Road Trip Case Study: Material Test Two Dimensional. (Digital photograph © Jill Mulholland 2006).



Fig. 163. The Road Trip Case Study: Material Test Three Dimensional. (Digital photograph © Jill Mulholland 2006).



Fig. 164. The Road Trip Case Study: Wind Tests #1. (Digital photograph © Jill Mulholland 2006).



Fig. 165. The Road Trip Case Study: Wind Tests #2. (Digital photograph © Jill Mulholland 2006).



Fig. 166. The Road Trip Case Study: Material Scale, Visibility Test. (Digital photograph © Jill Mulholland 2006).

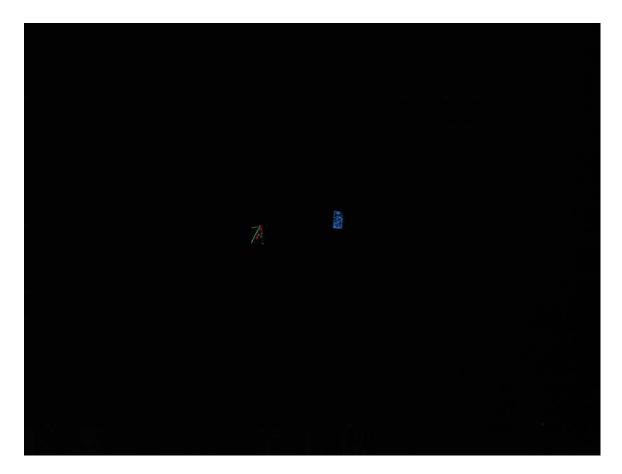


Fig. 167. The Road Trip Case Study: Material Scale, Visibility Distance Test. Note small color spots in center of photo. Viewed .25 miles away. (Digital photograph © Jill Mulholland 2006).



Fig. 168. The Road Trip Case Study: Three Dimensionality Test Day. (Digital photograph © Jill Mulholland 2006).



Fig. 169. The Road Trip Case Study: Three Dimensionality Test Night. (Digital photograph © Jill Mulholland 2006).

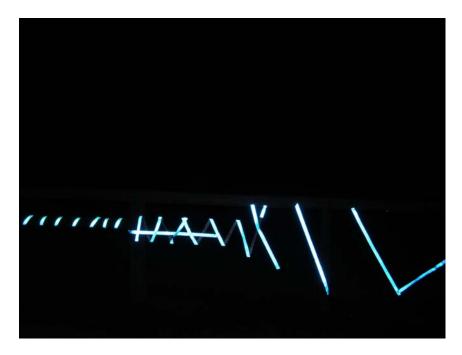


Fig. 170. The Road Trip Case Study: Fence Installation Blue. Continuous with Figs. 171 and 172. (Digital photograph © Jill Mulholland 2006).



Fig. 171. The Road Trip Case Study: Fence Installation Blue and Red. Continuous with Figs. 170 and 172. (Digital photograph © Jill Mulholland 2006).

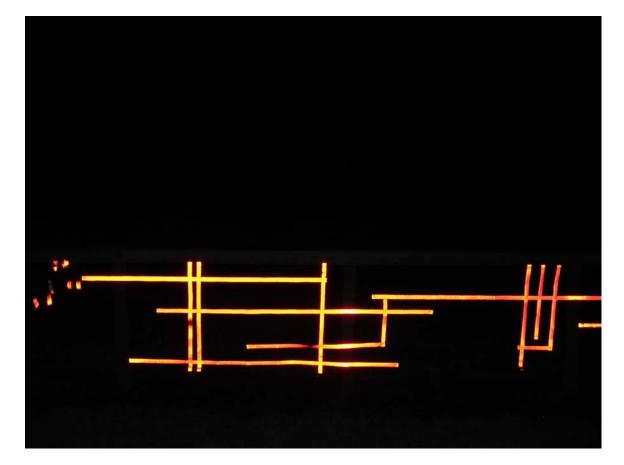


Fig. 172. The Road Trip Case Study: Fence Installation Yellow. Continuous with Figs. 170 and 171. (Digital photograph © Jill Mulholland 2006).

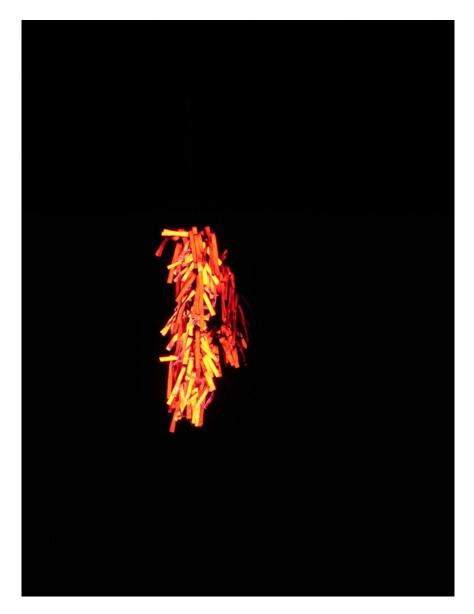


Fig. 173. The Road Trip Case Study: Direction Indicator Hairy. (Digital photograph @ Jill Mulholland 2006).

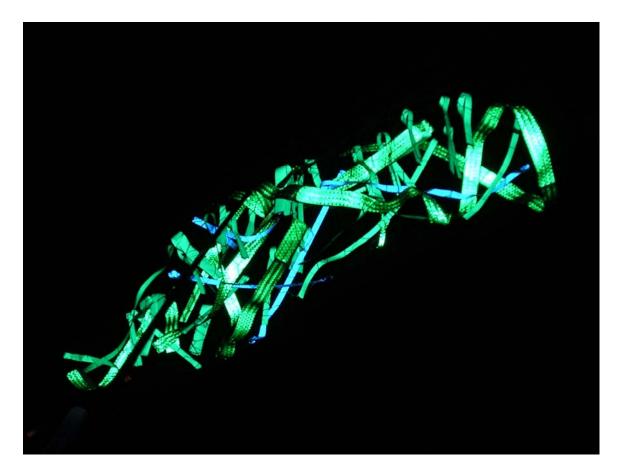


Fig. 174. The Road Trip Case Study: Direction Indicator Spinning Submarine. (Digital photograph © Jill Mulholland 2006).

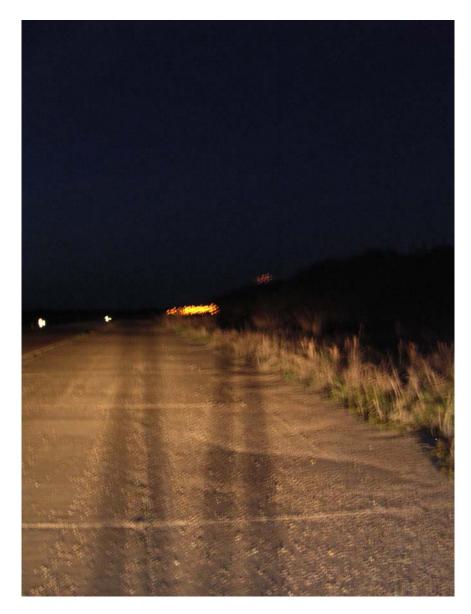


Fig. 175. The Road Trip Case Study: Hillside Installation Overview. (Digital photograph @ Jill Mulholland 2006).



Fig. 176. The Road Trip Case Study: Hillside Installation Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 177. The Road Trip Case Study: Direction Indicator Bouncing Curve. (Digital photograph © Jill Mulholland 2006).

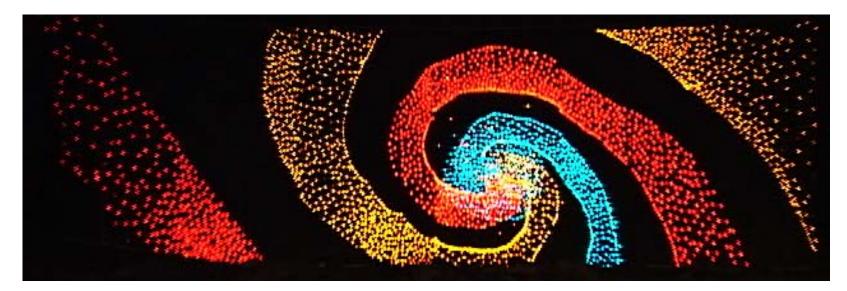


Fig. 178. The Road Trip Case Study: Mural Installation, 75' Wide X 24' Long. (Digital photograph © Jill Mulholland 2006).

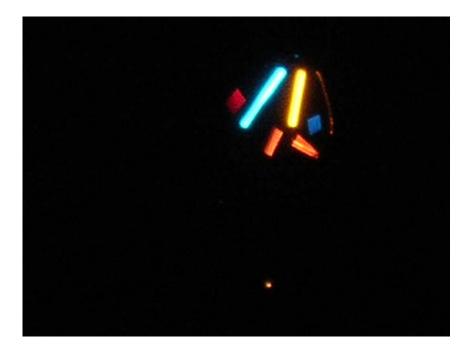


Fig. 179. The Road Trip Case Study: Direction Indicator Blowing Ball. (Digital photograph © Jill Mulholland 2006).

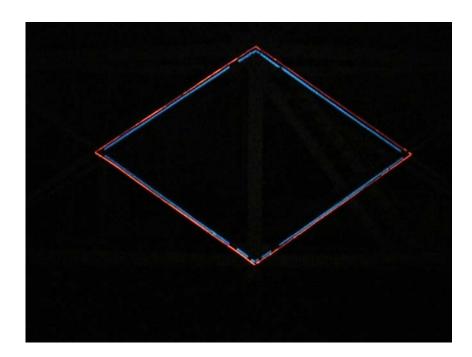


Fig. 180. The Road Trip Case Study: Tower Diamond Installation. (Digital photograph © Jill Mulholland 2006).

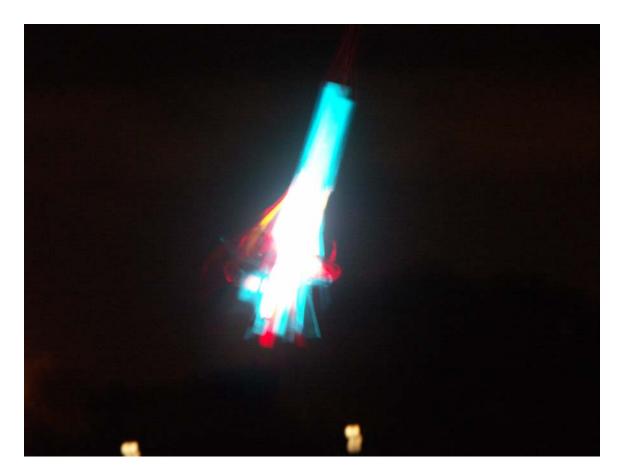


Fig. 181. The Road Trip Case Study: Direction Indicator Windsock. (Video still © Jill Mulholland 2006).



Fig. 182. The Road Trip Case Study: Lake Installation. (Video still © Jill Mulholland 2006).



Fig. 183. The Flora of BBNP: Ocotillo Scale. (Digital photograph  $^{\odot}$  Jill Mulholland 2006).



Fig. 184. The Flora of BBNP: Ocotillo Leaves. (Digital photograph © Jill Mulholland 2006).



Fig. 185. The Flora of BBNP: Ocotillo Thorns. (Digital photograph © Jill Mulholland 2006).



Fig. 186. The Flora of BBNP: Ocotillo Bark. (Digital photograph © Jill Mulholland 2006).



Fig. 187. The Flora of BBNP: Cactus Green and Nubby. (Digital photograph © Jill Mulholland 2006).



Fig. 188. The Flora of BBNP: Cactus Pink, Yellow and Green. (Digital photograph © Jill Mulholland 2006).



Fig. 189. The Flora of BBNP: Cactus Silver. (Digital photograph © Jill Mulholland 2006).



Fig. 190. The Flora of BBNP: Cactus Dark Pink. (Digital photograph © Jill Mulholland 2006).



Fig. 191. The Flora of BBNP: Cactus Needle Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 192. The Flora of BBNP: Cactus Freckled. (Digital photograph © Jill Mulholland 2006).



Fig. 193. The Flora of BBNP: Cactus Wrinkly. (Digital photograph © Jill Mulholland 2006).



Fig. 194. The Flora of BBNP: Cactus Buds. (Digital photograph © Jill Mulholland 2006).



Fig. 195. The Flora of BBNP: Cactus Baby. (Digital photograph © Jill Mulholland 2006).



Fig. 196. The Flora of BBNP: Agave Blossom and Scale. (Digital photograph © Jill Mulholland 2006).



Fig. 197. The Flora of BBNP: Agave Blossom Detail. (Digital photograph © Jill Mulholland 2006).

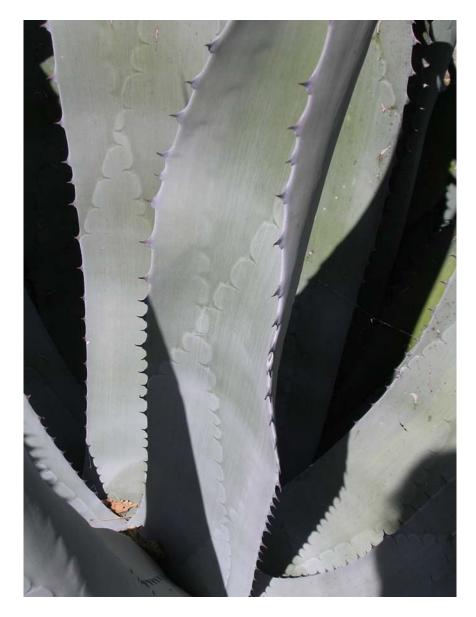


Fig. 198. The Flora of BBNP: Agave Base and Imprinting. (Digital photograph © Jill Mulholland 2006).



Fig. 199. The Flora of BBNP: Yucca Bud. (Digital photograph © Jill Mulholland 2006).



Fig. 200. The Flora of BBNP: Yucca Blossom. (Digital photograph © Jill Mulholland 2006).



Fig. 201. Future Research: Mixing Reflections. (Digital photograph © Jill Mulholland 2006).



Fig. 202 Future Research: Reflections Detail. (Digital photograph © Jill Mulholland 2006).



Fig. 203. Future Research: Materials. (Digital photograph © Jill Mulholland 2006).



Fig. 204. Future Research: Plastic. (Digital photograph © Jill Mulholland 2006).

## VITA

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Antique Lighting- Hippo Hardware, Portland, Saturdays, 1998-2000 Staff Lighting Designer- Ross DeAlessi Lighting, CA. 1994-95 Selected Lighting Projects: Assistant - to laser engineer, Burning Man, Nevada, 2002 Lighting Crew- Ice Alaska, Fairbanks, 2002 Lighting Designer- Warner Brothers Theme Park, Madrid, 1999 Lighting Designer-Pfizer Building 265, Connecticut, 2001 Lighting Designer- ICPH, Newark, NJ, 2000 Lighting Designer- Chevron Complex, Kazastan, 1998 Lighting Designer-Eugene Transit Station, 1998 Construction Administration- Atlantis Casino, Bahamas, 1995 Research and Author- Master Plan Lighting Cleveland Bridges, 1994 Selected Theatrical: Dance 93-lighting designer, Univ. of Oregon, 1993 Dance 92- asst. lighting designer, Univ. of **Oregon**, 1992 Dance 91-light board operator, Univ. of Oregon, 1991 Stage Hand- lighting, Hult Center Eugene, OR. 1990-1993 Selected Archaeology: U.S. Forest Service-MacDoel, California, survey, 1989 Salt Caves Dam- Klamath River, California, excavation, 1985 NSF - Belize, CA, Mayan excavation, 1982 Alaska pipeline- Saco, Montana. Excavation, 1981 U. S. Forest Service- Hayfork, California, survey, 1980-81 National Geographic Magazine- Belize, Mayan excavation, 1978, 1979