The magnificent play of light: seeing the difference
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# Contents

## INTRODUCTION
- Research Rationale  
- Methodology: Theoretical approach

## DESIGN KNOWLEDGE, CONTEXT AND INSPIRATION
- Introduction
- Historical Background
- Design Pedagogy
- Observations as an art /design teacher
- Visual Language
- Visual perception - looking and seeing
- Observation and Drawing
- Compositional Techniques
- Optical Illusion and Ambiguity

## COMPONENTS PROVIDING SPECIFIC IMPETUS TO MY PROJECT
- Light
- Light as Colour
- Water
- Glass
- Plastic

## SETTING THE SCENE
- Light in art
- Illusion
- Abstraction
- Light on glass
- Light on water
- Photography
- Digital photography
- Computer manipulation

## MY ART AND DESIGN PRACTICE
- My project
- The Process
- Equipment
- Subject matter
- Timeline and Study sites
- Compositional Techniques
- Glossary
- Analysis and selection

## IMAGES AND DESCRIPTION

## MY PROJECT OUTCOMES

## REFERENCES: BIBLIOGRAPHY: APPENDIX
- References
- Bibliography
- Appendix : Glossary
Abstract

Light as a concept is filled with a multitude of interpretations, ideas and possibilities and no matter how technologically progressive we think we are, nature consistently controls our human way of life. We are surrounded by nature and often gain inspiration by the simple things around us. My interest in the phenomena of light and refraction was sparked years ago by Claude Monet's painting *Bathers at La Grenouillere*, 1869. It showed simplicity of form and shape, yet emitted a luminosity and radiance of light reflecting off water.

This thesis examines the subject of light as an optical phenomenon. My specific aim was to create distorted, ambiguous and conflicting images in my photographs by using the ‘optical phenomena’ of light such as, refraction, diffraction and reflection as a basis for abstracting reality. I wanted to capture the changes that occur when light changes direction due to refractive qualities within a material such as glass, water or plastic, or due to the reflective qualities of a surface.

The camera was exploited for its capacity to capture realism, but also to capture and abstract natural phenomenon. The images were enlarged to magnify details and the reality of the physical world was heightened as objects became ambiguous. Design compositional techniques were used to decontextualise objects.

I approached this study with the idea that observation and awareness has importance to image making within my design and teaching practice. This thesis presents my project explorations showing the play of light on and through surfaces under different conditions. I have documented this by producing a series of photographic images and a glossary as an aid in the practice of design education.
INTRODUCTION
Introduction

Since the beginning of time many cultures have worshipped the sun and its light. Many artists talk of an extreme sensitivity to very subtle effects of light, reflection and texture. Various artists have tried to capture light, as can be seen in the dazzling fragmented Gothic stained glass windows, the golden illuminated manuscripts produced by monks in the Middle Ages, and in the landscape paintings of Turner and the Post Impressionists showing changing light conditions. (Cowart:1997)

The objective of this study was to investigate the play of light on and through surfaces under different conditions, and to document this by producing a series of abstract photographic images and a glossary. Light is continually changing and when it is shone in a different way onto a different part of an object, or under various weather conditions, it produces accidental features. The object appears to come alive and we have a chance to see it in a new way. The transparent media of water, plastic and glass, act as a prism and diffract light into coloured fragments and facets, creating distorted or ambiguous images.

I wanted to explore a variety of illusions created through the interaction of light with glass, plastic and water. I hoped to be able to explain the types of abstract images that can result from this phenomenon, in terms of the circumstances needed to produce specific examples.

Everything has been seen before, however the observation of the world around us provides abundant visual images useful in creating strong graphic messages. Image making within graphic design is important as it defines the differences between graphic design and desktop publishing. (da Pos in Sivik, 1996, P17)

“Anyone with a home computer, access to more software than was safe, a printer and a disc of clip art could - and did - claim the title of graphic designer. The result was an abundance of ill-conceived and poorly informed design. Their creators could hide behind a façade of aesthetic digital trickery with little regard for concept or content. It diminished the masterful achievements by such industry greats as Saul Bass, Abram Games, Paul Rand, Cipe Pinellis, Alexy Brodovitch, Lester Beall and the many others who, since the ’50s, had breathed credibility and respect into graphic design.” Bawden (2005)

This study has produced a teaching resource that can demonstrate compositional techniques as well as justifying the use of illusion and abstraction. These techniques are important in attracting the attention of, and conveying a visual message to the intended audience. In graphic design we need to deal with communication not only based on text, but we also need to communicate with symbols, colour and image.

This thesis is structured in two parts, ‘Context and Inspiration’ and ‘My Journey’. The first is an exploration of theories and observations relating to light and image making and their relationship to graphic design, as well as to design and art education. ‘My Journey’ presents an insight into my image-making procedure from a personal perspective, through life experiences as a student, an educator and a practitioner of graphic design and visual art.

To illustrate my journey I have produced a series of photographic images and a descriptive glossary. By producing this series of photographs using light, glass, plastic
and water, I wished to show everyday items and matter in an innovative way. To demonstrate the phenomena of light, the images show ambiguity, distortion, and strangeness - the unfamiliar in the familiar.

“...To awake the sense of wonder in ourselves is to look intently, undeterred, at a single object. Suddenly, miraculously, it will reveal itself as something we have never seen before.” Cesare Pavese (Fletcher: 2001:194)

Research Rationale

The intention of this research is to construct a theoretical framework in order to reflect on the image-making process, based on seeing and looking, within the practice of graphic design education. My objective is to understand the substance and context of the image making process and present this assessment through an examination of light and its properties. To achieve this objective, this study will look at some essential history of design education, as well as elements of visual art that have inspired me to look at light. It will also explore the conception, implication and effects of light and composition in creating an abstract image. A list of criteria to illustrate the properties of light and their function in creating abstract images will be developed, and a set of images exploring the research will be produced. The resulting in-depth understanding of the impact of light and its properties will help to determine the function of my images and reinforce the importance of looking and seeing in graphic design practice.

I wanted to show the unfamiliar in the familiar by capturing images of optical abstractions formed when objects are transformed by the unpredictable play of light. My goal was to analyse the properties of light and to demonstrate the abstract potential of light, and the effect on colour and shape when light interacts with water, glass and plastic. The specific aim was to create distorted ambiguous and conflicting images in my photographs by using ‘optical phenomena’ of light, such as dispersion, interference, refraction, diffraction and reflection, as the basis for abstracting reality. I hoped to use light, and its qualities of distortion and abstraction, as a creative medium to demonstrate illusion and ambiguity. I also aimed to also use compositional techniques as a method to focus on ambiguous qualities within my images.

An additional aim in this research study has been to sharpen my observation skills by using an inquiring eye to look at everyday items and the wonders of nature around me. I sought to see more in the minuscule particles of nature, to discover something anew in the wonder of our environment. I would like to use this study to inform my future creative output in art and design, to expand my visual ideas by sharpening my visual perception and reflecting on what I see in my images as a way of increasing my creative resources. By exploiting the illusional properties of glass and water, I wished to produce images that could be used in my design and art practice.

By looking at my images, viewers could be challenged to re-look at everyday occurrences and objects that surround them - in other words to become more visually aware of something seen previously. I wanted to try to awaken a sense of surprise, a sense of wonder, a new way of looking at and talking about the phenomena of nature. Since vision and language are intertwined, these images may be of use in my teaching practice. They could be used as a teaching resource to encourage design students to see the world in a fresh and creative way.
Methodology: A theoretical approach

In the past, many research investigations followed the traditional 'objective scientific' method. However, since the 1960s there has been a move toward a qualitative, naturalistic and subjective approach. My approach draws from both methods. My research is based on a personal creative project, which involved selecting and interpreting the physical properties of light and their effect on water, plastic and glass. However, when producing a series of images and a related glossary, I have tried to distance myself from my personal understanding and to rely on my observations. Photo-observation is used in the social sciences such as ethnography, to record social interaction, but photography used as a research method may raise problems, in this situation due to observer awareness. ‘What we observe is not nature itself, but nature exposed to our method of questioning.” (Heiseberg 1958, in Wagner: 1979) The purpose of observation is not simply description and examination, but also an interpretation of the photographers’ awareness, the use of equipment, printing methods, editorial processes and the setting for the photograph.

I have chosen to document the play of light on form within its own settings and to draw conclusions by analysing data, patterns and explanations based on detached observation. My photographic images do not convey a story or a message as they are recordings of nature.

“The attitude of the objective artist is one of detachment…The artist interested in accuracy also wishes his results to have a validity independent of personality...” (Feldman: 1981:150)

The requirements that I work to are both objective and subjective; the objective conditions are specialized and allow for measurement and direct contrast. When taking photographs I tried to be as objective as possible, in other words, I did not arrange the setting, the subject matter or the lighting. I tried to shoot the photographs free of any bias caused by my personal feelings, relying solely on the facts before me. However, the subjective nature of my decision-making appeared in my thoughts and opinions on, for example, how to compose the photograph to gain the most visual impact.

I was able to select, focus, simplify and transform the data in a process of data reduction. Writing summaries, labelling/coding and writing memos to myself during analysis were all part of data reduction. Data reduction helped to sharpen vague terms as well as to sort and organise data in such a way that final conclusions could be drawn and verified. This process could also be termed data condensation. (Chevalier: 2006)

My epistemological approach dealt with constructivism - the means of production of knowledge about light on and within water, plastic and glass, as well as with how this knowledge was acquired. As a theoretical perspective informing methodologies of research such as mine, it was quite clearly the phenomenon of light that needed to be studied, in the hope that, “multiple realities and ... meanings that exist within different contexts may become apparent.” (Sarantakos, 2005:40) Understanding and interpreting the phenomenon of various lighting conditions used over form and within matter, was integral to my study. My epistemological approach related directly to Sarantakos' statement on research and constructivism:

“Constructed realities are not uniform; interpretations vary from person to person. This means that what people perceive is not reality, but what they have constructed through experiences and interpretations.” (Sarantakos: 2005: 37)

My research position is shown in the method of data gathering. “No one methodology can answer all questions and provide insights on all issues” (Burns: 1994:11). I feel that my
position is varied, as I have come from a phenomenological and constructivist perspective, yet I have also used a qualitative process of collecting data from my photographs. Burns (1994) Cooper (1998) and Sarantakos (2005) base qualitative research on constructivism as it conveys human subjective life experiences and relationships. Meanwhile, phenomenology relates to people’s reflection on their experiences and interactions and how they construct their everyday world. (Luhman: 1997, Lueger: 2000) By researching light on form, my study incorporated the central principles of this methodology, as described by Sarantakos (2005) and are taken from "a relativist orientation, a constructivist ontology and an interpretivist epistemology" (P37)

"Unlike quantitative methodology, qualitative methodology is diverse, pluralistic and in some cases even ridden with internal contradictions. This is due to the fact that it contains elements from many different schools of thought, which are integrated into this research model." (Sarantakos: 2005: 36)

The approach for collecting data was highly functional; however, in its resolution it created another research issue, that of interpretation and analysis. It became inevitable that interpretations would be varied. My methodology acknowledges the multiple and contradictory perspectives of vision and meaning. Because of the subjective nature of qualitative data and my informal and flexible methods, it is "difficult to apply conventional standards of reliability and validity." (Burns: 13) My photographs are original and unrepeatable; this creates a qualitative research problem, as it makes replication impossible. (Katz: 1983: 128 in Foddy: 16) The basis of my organising structure was unique as it relied on the use of the properties of light, when it shone on and within water, glass and plastic. Inductive analysis and data reduction was used to organise data into themes, and was a transferable research methodology. Documentation of naturally occurring phenomena was used to illustrate particular formulations of themes.
DESIGN KNOWLEDGE, CONTEXT AND INSPIRATION
Design Knowledge, Context and Inspiration

Introduction

The chapter begins with an introduction to the background of design and art education, in an effort to set the parameters and make a case for the importance of image making within the practice of graphic design. This background will reflect on and identify the reasoning to justify the significance of this study, as theory needs to inform practice. There was a requirement for educators to observe and assess student needs and adapt teaching to suit. My research project was aimed at explaining or expanding knowledge about the reasons why students need to learn about the importance of looking and seeing, as "Images are the starting point of all our thinking and feeling." (Kepes: 1956:22)

Perceptual education precedes and underlies concept. "Method without theory or practice is too abstract, perhaps even pedantic. And method without an underpinning theory is mysticism, while method without practice is meaningless."(Poggenpohl 1998 in Barrett: 1999:123)

DESIGN AND ART EDUCATION

Historical background

The study of design history is still quite new as previously it has been included in the study of art. Sometimes design history is undocumented and is often reduced to a listing of successes of individual designers, design groups or design schools. Graphic design has a short history and it is only in the last few years that any real attempt has been made to theoretically analyse it. "The history of graphic design in Australia," Bawden (2005) states, "is not well documented." The term 'Graphic Design' originates from, "William Addison Dwiggins, author of Layout in Advertising, published in 1928, in which he used the term to describe the practice of manipulating type and image into persuasive messages." (Heller & Balance: 2001)

"Professional design, as we know it, emerged in the late 1800s as a crusade to bring quality of lifestyle, honesty of manufacture and a purity of aesthetic to the masses. The design crusade had its roots in the Industrial Revolution, a continuity of changes in technology, economic systems and social organisation proceeding from the mechanization of manufacturing..." Robertson (2007)

The introduction of mass printing during the industrial revolution led to an upsurge in the quantity of printed material. With the development of the colour lithographic printing process in the 1860s, many artists of the day, such as Manet, Cheret, Bonnard, Mucha and Cassandre, produced illustrations and typography for posters, advertisements and
books. These artists could well be regarded as among the first graphic designers. (Barnicoat: 1988)

During the first few decades of the twentieth century, art was influenced by the intense hostility and unrest in Europe. Closely associated with art movements at the time was the Bauhaus School, established in 1919 in Weimer, Germany. Its principle aim was to bring together art and industry and it initiated many modernist innovative ideas in design. Many of the typographical practices in graphic design, in particular the development of sans serif typefaces and the hierarchy of information are still current today.

In the past, design education was usually taught within the apprenticeship system. However, in the twentieth century art and design schools were established, and educators began to discuss and document teaching pedagogies. The Bauhaus, established in Germany in 1919, was possibly among the first educational establishment to document the teaching of art and design, having a curriculum based on the craftsman and the materials used. (Stein: 1976, Wick: 2000) The Bauhaus has had, and continues to have, a major impact on the teaching of art and design around the world. It was unique and was well known as a place where avant-garde ideas thrived. The Bauhaus first year foundation program in design became the model for foundation programs, for study in all disciplines of design, at most art and design schools. However, today a combined interdisciplinary foundation year seems to be offered only in a small number of design schools. (Lupton and Miller: 1993)

Between the wars technical improvements in printing and the reproduction of photography followed with colour printing techniques. The Arts and Crafts movement arrived in America in the 1930s and some craft units were introduced into the education curriculum. After 1945 graphic design courses evolved in art colleges and technical colleges. However, it was not until later, between 1955 and 1965, that there was a proliferation of visual art programs at universities.

"The first Fine Arts program ...was at Yale University...Industrial design was first taught at Carnegie institute...after World War II, some combination of photography, printmaking, industrial design and advertising design (after 1965 it became graphic design), fashion, ceramics, wood-working, glass blowing and jewellery design were added to the Fine Arts program at most universities."

(Kelly: Effective Programs: P1)

Graduate designers moved into an expanding field of publication, design, advertising, television and corporate design. Many designers had migrated to USA during the war and by the 1950s the art centre of the world transferred from Europe to New York. (Conway: 1987) During the 1960s Pop art influenced the symbolic elements in graphic design and reflected an upsurge in social awareness. The arrival of design education in Britain in the 1960s arose because of new technologies, and sociological change that influenced a new curriculum movement. (Eggleston: 1976). This process also took place in Australia, during the 1960s and 1970s, within the education area covered by the TAFE (Technology and Further Education), CAE (College of Advanced Education) and Art School institutions. In the 1970s the Post Modernist movement in Switzerland revised the clinical ‘international typographical style’ of the 1950s and some of the unstructured design style developed in American was used in response to new technology. (Walker: 1989: Barnicoat: 1988)

Now advertising, corporate images, branding and web design are playing an important role in graphic design. Today we are in the electronic age of computer graphics, websites and media graphics, challenging the old concepts of what is graphic design. (Foges: 1999)
Design pedagogy

Walter Gropius, a founding member of the Bauhaus, felt that "art cannot be taught… for art is not a profession. But proficiency in a craft is essential to every artist" (Stein: 1976: 31). We need to understand that at the Bauhaus, art and design were taught as one and the same. Gropius stated that, "we are not in a position to awaken creative powers and to develop the innermost thoughts and feeling of young people through educational means. This can only be done through what we call personality. Only matters of knowledge and skill, theory, and practice, can be taught." (P51) Itten declared himself, "in favour of free artistic manifestation as a pedagogic principle." (P51) Josef Albers felt that self directed learning allowed students to become creative by self experimentation, he stated that the student, " has learned and not merely been taught," and "the best education is one's own experience. Experimenting surpasses studying… instruction in professional techniques hampers inventiveness." (P142)

I feel that, when teaching design, we need to look at both technique and creativity. In my experience, a major problem of teaching within design and some areas of visual art is a lack of knowledge by the teacher about the techniques for using media and materials. Photography, glass making, ceramics, printing, all creative artistic activities, are taught various techniques and methods relevant to their discipline. When learning photography you are not expected to know how to take a photo, you are taught the technical means of using the camera and what lens, aperture and light reading is necessary to gain a certain effect. Eisner (1972), and Gruson and Staal (2000) felt that designers, illustrators and painters were encouraged to try new techniques and media, but were frequently not actually taught new techniques or given information about new media. They also found that many teachers felt that technique interfered with creativity. Some teachers did not themselves know the various techniques, and this lack of knowledge was perpetuated, as they were unable to teach techniques to their students.

Loughran (2006) stated, “Pedagogy is the art and science of educating … focussing on the relationship between learning and teaching.” (P2) He felt that we must, “pay attention to the subject matter being taught but also to the manner in which it is taught.” (P4).

Design when treated as problem-based learning is a way to encourage and develop skills of enquiry in students. (Boud and Feletti: 1991) Donald Schon (1988), a well-known education authority and a strong exponent of learning by doing and action learning, believed that design students cannot be taught what they need to know, as they must be coached. He felt that students learned by practicing, observing and by reflecting on their actions.

Levi and Smith (1991), stipulated that the purpose of art education is to cultivate habits of perception - students who are perceptually deprived need to be encouraged to see. They felt that the building blocks of knowledge must be built upon, and art teachers must become familiar with the principles of design. Swann (1997) also felt that before we can create something visually, we need to learn to look and how to look, rather than just relying on our physical sense of sight.

"The artist experiments, observes certain effects and brings her judgment to pass on whether the technique that creates the effect is suitable for application. The visual system, rather than being a source of rigid constraints, becomes itself an exploratory tool, directed towards the goals the artist sets for herself." (Church: 2000: 99-111)

Read (1964) felt that art should co-ordinate the various modes of perception and sensation with one another and in relation to the environment. The cognitive process and the stages of students’ perception in the drawing/design elements and principles have been documented as well as the stages of artistic development from young children to mature adults. (Johnson: 1993, Read: 1964)
My observations, when teaching art and design, also related to these cognitive stages and processes. I observed that students aged from 5-11 years were free and unbiased in their response to projects, while those aged 12-17 became obsessed with trying to capture reality in their drawings and paintings, and were very concerned with the reactions of their peers. Students may have been told that they could not draw, and this created a loss of confidence and an unwillingness to try. Students aged 18 plus, were also concerned with capturing reality in an effort to make something recognizable. Although willing to try new ideas they were sometimes reluctant to attempt a project in case they got it “wrong”. Information on the cognitive process and the stages of students’ perception, has implications for design education as the young adult group are the student majority attending university; they are often already set in their ways and are willing to replicate examples of design that they see around them, rather than produce unique creative results. They have learnt to look, but seem to have stopped seeing and this has become a major concern for teachers of design. (Kepes: 1956, Culkin: 1977)

SIGNIFICANCE TO MY RESEARCH PROJECT

Observations as an art and design teacher; computer influence on design skills

Graphic design students see much around them that was mass-produced using desktop publishing programmes or by people untrained in graphic design. Students assume that the designs that surround them must be the norm. Graphic designer Cathie Broughton interviewed by the Sydney Morning Herald, August 2006, illustrated this point when she said, “Computer skills alone do not make something pleasing to the eye...when desktop programs first came on the market every secretary thought they were a desktop artist, and you saw some awful logos and designs.” (Carey: 2006: 28) To combat the increase in desktop publishing we need to make design unique and one way to achieve this is to make students become more observant in a bid to encourage originality. As everything has been seen before (Gregory: 1977), we need to encourage students to see the unfamiliar in the familiar. I have encouraged students to produce their own visual imagery by either photography, computer manipulation of their own photographs or their own illustrations.

New technologies have brought about changes in the methodology of teaching and as Frankham (2006) stated, “Teaching time taken up by students learning software is increasing.” There appears to be a need to integrate design theory and the learning of new graphic design software programmes as many students find it hard to grasp the interrelationship of design and technology. Jessica Helfand feels that,

“"The very value of design is in question...with sophisticated electronic options, one might argue that the function of design is marginalized - if not rendered entirely obsolete - or that the role of the designer itself is imperilled. We have unwittingly ceded control: to our computers." (Bierut, Dentiel & Heller: 2002: 166)

I would like my students to use the computer as a tool as,

“"Technical skills can be learnt or taught, freedom and spontaneity cannot...(it is the) teachers’ responsibility to provide circumstances that foster freedom and spontaneity and at the same time encourage certain disciplines, sharpened perceptions and refined sensitivities are the by product of this progress"” (Themal: 1977)
Because of a new teaching methodology, graphic design students are now taught in tutorials, whereas “previously design had been taught in a studio environment.” (Juster: 1999: 25) The social environment of the studio no longer exists as students now work at home only coming to university for lectures and tutorials. Usually students buy their own computer by the end of their first year. Working in isolation creates problems: they are not seeing and being influenced by the work of their peers nor were they receiving feedback on their work in progress. Students spend many hours designing on the computer and are sometimes unwilling to make changes. Feedback is part of the observation process and it is helpful to gain another opinion of work in progress. Feedback is important as students often feel they cannot rely on their own judgment. Philippa Ashton (1996) claims that the idea that learning can take place in isolation must be challenged. Design students are not seeing what is wrong in their work as they move on without reflecting not looking back on their work as they progress In design teaching, as mentioned earlier, we use the process of ‘action learning and reflection’. (Schon: 1988) This process does not happen on the computer unless the student has been taught to save all their changes. When students begin to design on the computer, they forget that the computer is just a tool; this plus the amount of time spent on the computer are factors that impact on and influence their design decisions. Poor use of technology is creating poor design. My observation of this trend made me think about how my students could be trained to see and look as well as reflecting on their work.

**Visual Language**

When I studied design in the 1970s we were taught the design elements and principles and it was assumed that we knew how to use them, however they were taught in isolation. I have realised, after working and teaching in the field for many years that nothing appears to have changed. We tend to discuss student project work more from a personal and emotional viewpoint and this creates confusion for both the student whose work is being critiqued and the students who are listening.

Critique sessions tend to generalise and they would be strengthened by the use of the design elements and principles as our terminology/vocabulary. This vocabulary would increase student understanding of the reasons why something looks right or wrong and communicates effectively or ineffectively.

"Articulating criteria helps students critically analyse their work, relying less on intuition and more on rational evaluation…the use of terminology, established criteria and gives meaningful criticism of student work… We need to be clearer in our reasons for making decisions and suggestions.” (Kelly: n.d.: 3)

In working with other teachers, it was apparent that sometimes we have different terms for the same principle. The most important consideration is that teachers be able to explain what they teach, and to effectively evaluate student work. A few principles have more than one definition and students need to know about these different interpretations.

Designers use a variety of words that interact within the context of the discussion to convey the same meaning. Some examples are colour/hue, saturation/value, tone/shade, and size.scale. There is an implied understanding of the meaning of the words and terms by both the teacher and the student. The use of design terminology becomes a methodology of ‘seeing’ when used to critically analyse design work. We all can look but we need to be taught how to see, we are all capable of hearing but we all need to learn to listen. ‘Design speak’ is used to help show the student exactly what is happening in the layout of their work and to explain why we are drawn to look at something.
Students appear to lack the confidence to ask for the meaning of words they do not understand. They tend to look at graphic design examples in the vast array of pictorial ‘show and tell’ books, but they do not appear to know why one piece of design is better than another, so they become copyists, regurgitating the same thing over and over again. Students seem not prepared to investigate their own ideas, “The majority of students working on design exercises do not understand why or what they are doing. The lack of understanding affects their commitment and productivity.” (Kelly: n.d.: 3)

Words form the basis of language and are connected to words we already know, new words, other concepts, facts and specific memories. Words are the tools we use to access our background knowledge, comprehend new knowledge, express ideas and learn new concepts. (Stahl and Nagy: 2006)

“Visual literacy is an ability to view any image as an abstraction, to understand what is happening in purely visual terms as well as knowing and understanding visual terminology. It involves training the eyes to see minute detail and being sensitive to colour, shape, form and line. It has little or nothing to do with content or style. Visual literacy applies to all the visual arts and crafts without exception.” (Kelly: Pedagogy: 3)

By producing a glossary of terms, my aim was to supply the meaning of words used to describe my images. Certain terms such as, value, saturation or depth, are commonly used in everyday language, but have different meanings in design and art terminology. All my photographs were composed of different elements, and by constructing my glossary it helped me to analyse, reflect and better understand my images. In each image I tried to show particular examples of the properties of light and the properties of water, glass and plastic. The terminology used was specific to my photographs and included terms relating to weather, the scientific phenomena of light, photography, the technical properties of water, glass and plastic, and the visual language of art and design compositional techniques. Words were the tools used to review each image in order to produce my glossary. The process of describing my images enabled me to look more closely and to find hidden content of which I had been unaware.

Visual literacy was defined as the “ability to construct meaning from visual images.” (Bamford 1999: 146) John Olsen, in Encounters with Australian Artists, stated that, “it’s the function of artists to show people how to look, how to see… pictorial composition, balancing space, light, colour, form that makes the picture irresistible to the viewer…we all look at the same horizon and see different images.” (Hawley: 1993: 109)

“...we can learn to identify the elements of images. That is, we can learn to focus on the shape colour, texture, or light patterns which are parts of images. In fact, when we focus on part of an image - its shape, for example – that part becomes the image; it becomes the meaningful focus of our interest…the labels for the visual elements tend to vary according to the user, but what the label refers to is fairly consistent. It does not matter greatly if one authority uses 'form,' another 'contour' and a third 'shape'. What is important is that the viewer understands the properties of art which the words designate.” (Feldman: 1981: 233)

Visual literacy is one of the traditions of modern art and design and it investigates a wide range of practical and conceptual approaches to art making, from line, to plane, to structure and composition, to materials, symbols, and motion. Van Hombrigh (1965) spoke generally of the arts when he said that, “Each form of art, such as dance, music, theatre use different elements, such as chords, steps, speech etc.” However although each form of art uses a different 'language of expression', each uses “the same basic qualities of art, such as unity, rhythm, repetition, harmony and balance…” and these terms also relate to graphic design. “The painter uses the language of visual art. He creates a picture which expresses his ideas and feelings in line, direction, shape, space,
size, value (light and dark), texture and colour.” (P87) Wallschlanger and Busic-Snyder (1992) explained that,

“Both two and three dimensional compositions and forms are created by combining the subject matter, meaning, or intent with materials or media; the result is a tangible figure or form. During the ‘generation’ of a form, artists, architects, and designers manipulate components to devise and produce meaningful art forms, products, buildings, interior spaces, communications and so on...form generation involves media, the elements of art, and the principles of organisation, employing balance, movement, proportion, dominance, and economy to produce form unity.” (P9)

The Bauhaus created manuals that outlined organised principles of communication. (Drucker: 2002, Wick: 2000) Paul Klee and Wassily Kandinsky, painters and educators at the Bauhaus in the 1920s, “tried to identify an abstract and universal grammar of visual expression...in graphic design: the concept of a ‘language of vision.’ This abstract ‘language’ of line, shape, and colour has been theorized as a system of visual communication...” (Lupton: 1988: 1). Johannes Itten, the first teacher of the Basic Course at the Bauhaus, “outlined some of the principles of design using his theory of polar contrasts, for example, a picture is organized by such formal oppositions as big/small, short/long, straight/curved, pointed/blunt, much/little, light/heavy, and hard/soft.”

During the 1930s and 1940s, Kepes and Lazlo Moholy-Nagy, taught at the New Bauhaus in Chicago, and “further elaborated the theory of visual language and gave it a scientific rationale.” (Lupton: 1988: 1). Kepes felt that the development of visual communication depended on gaining a knowledge of visual expression and that this knowledge would “generate a genuine ‘language of the eye’, created by images whose elements are the basic signs, line, plane, halftone gradation, colour, etc” (P2). Kepes’s grammar used the “factors of organisation” principles from Gestalt psychology: “according to Gestalt theory, the brain spontaneously orders and simplifies sense data into structured and wholistic patterns... the figure/ground relationship is the precondition for perceiving objects” (P7). Kepes used such principles as line, contrast, dynamism, balance, proportion, rhythm and depth. (P8)

In the twentieth century the concept of “the languages of design,” begun at the Bauhaus, was a drive “to articulate a set of universals within formal visual expression.” (Drucker: 2002: 170) The principles of formal relations were considered to be unconditional, controlling visual elements, they became the formal methodologies for the production and analysis of visual work. Swiss design of the 1950s, had an international influence on many designers and was based on the grid as a form of visual organisational hierarchy. (P170) The significance of literacy in design was, “important for the designer to understand ... vocabulary associated with the analysis in order to reflect more clearly on the decisions made in their own work.” (Noble and Bestley: 2005: 92) A knowledge of an interpretive understanding of design language could create, “a renewal of design theory ... reinvigorate the community of graphic designers by encouraging critical thought about the means and ends of our work.” (Lupton and Miller: 1993: 2) Krees and Van Leeuwen aimed to provide at least a rudimentary vocabulary by which to explain and make visible some of the cultural value/practices at work behind “literacy,” as the language of vision operates in a broader field of social and linguistic values. They stated that, “we seek to break down the disciplinary boundaries between the study of language and the study of images, and we seek, as much as possible to use compatible language, and compatible terminology in speaking about both, for in actual communication the two and indeed many others come together to form integrated texts” (Dillon: 2005: 183) McCoy raised the question, “if today’s interactive media is a new landscape, then the old ways of graphic design may no longer be pertinent. Do we need extra dimensions beyond vision and hearing, do the contact senses of touch, taste and smell need to be included in this new century of technological design discourse?” (McCoy: 2002: 210)
"Visual perception is marvellous - despite all scientific research and philosophical attempts to penetrate it - still a mysterious mechanism." (Endt: 2005: 14)

"We see and then we think, we are affected by what we see and then think about it." (Burnett: 1995: 30) "Visual knowledge and correct expectation will facilitate perception, as vision is the primary medium of thought." (Arnheim: 1970: 18) Before we can create something visually, we need to learn to look, how to look, rather than just relying on our physical sense of sight. We can all see, but in this age of visual mass media, we are bombarded with stimuli, we have forgotten to stop and spend time actually looking at, and reflecting on, what we have seen. Kepes (1956) and Culkin (1977) felt that we have forgotten to look closely, to see details, to open our eyes to the wonder of the world around us. Everything has been seen before, but that there must be "a 'constant becoming' in the work, which will ensure that the experience is always renewed." (Berger: 1972: 25) When we look at objects we don't really see them. Most people never learn to see well and need to be taught to see and process this visual information, to constantly re-discover the world 'to realise how extraordinary is the ordinary'. (Edwards: 1999) I think that drawing is one of the vital components for perceptive training. Photographic images like mine also help to focus our attention in order to assist us see the wonder around us.

Perceptual studies explain that perception is a method of processing information. Perception is the awareness or the process of becoming aware of objects. We see our surroundings by sifting through past experiences and sorting visual stimuli into groups, then our mind translates this information. This is a survival process, and if we did not have this unconscious reaction we would be inundated by the amount of visual stimuli that enters our field of view at any given time. (Gregory: 1970) Kalish (1973), explained that perception was the process of organizing and interpreting sensory stimuli into meaningful patterns. Stimulus characteristics, such as size, colour, shape, movement, contrast, uniqueness, and repetition play a major role in perception. Because we have different perceiver characteristics, we tend to see different things, or interpret the same thing in a different way, or not notice things at all. When we first look at an image we form an initial first impression and then ignore other possible solutions. It seems that, at the scene of an accident, recollections may vary from witness to witness. (Gregory: 1970) Perception can be distorted because of qualities of the stimulus or the qualities of the perceiver. A mistaken perception can occur due to an optical illusion, for example, when a twig in water looks broken, even though we know it is straight. Active observation differs from passive seeing in that the observer is more involved and this ability to observe is imperative in the search for original creative design solutions. (Stafford and Terpak: 2001) As a designer I am always searching for new and unique ways of presenting design solutions. As discussed earlier, graphic designers have been challenged by the introduction of desktop publishing programmes. Now we need to produce more original design solutions to re-establish the role of graphic design within the commercial sphere. By producing my own images for this study I have built up a portfolio of work that I can use as a design resource to inspire my own work and that of my students.

My images have been produced to show that even in a visually saturated world there is still a large collection of natural occurring phenomenon to see. All of a sudden, with photography we can enter a world not normally seen. My images are grounded in the nature of vision, how we see and understand the world. I have increased the visual impact of my images by using compositional techniques as a method or tool, to convey my interest in the visual effects of illusion and ambiguity that can arise when viewing objects and the human figure, through glass and water.

An optical illusion is one way in which, "the designer can help to focus the intended message more clearly in the eyes, and hands, of the viewer." (Noble and Bestley: 2005: 22)
What makes us look at one thing and not another? We have all been forced to look at a piece of work, be it a poster or a book cover or a magazine cover. Could it be the use of a bright colour or a contrast of size or shape, could it be the repetition of a motif that has attracted our eye or is it an image that conveys ambiguity or illusion? Most optical illusions are the result of the inability to interpret an object from the context provided by the image. In my photographs I have tried to supply some visual clues and yet decontextualise the image at the same time. As a means to distort an image and thereby create abstraction or optical illusion in my photographs I have used the natural phenomenon of light and its properties such as refraction, dispersion, diffraction, interference and reflection and their impact on the properties of water, plastic and glass. These phenomena when seen up close convey startling representations, which may be used to create original design solutions. In each image the interplay of light on water, plastic or glass creates an illusory or abstract effect, which attracts the eyes as if to solve a puzzle.

Observation and Drawing

Matisse said that when he ate a tomato, he just looked at it, but added, "When I paint a tomato, I see it differently." (Swann: 1997: 10) Swann felt that drawing enabled students to see as it helped them to observe the object more intently and actually see rather than just looking. However, he believed that students rarely acquired skills and techniques to produce good drawings. Lumsdaime and Lumsdaime (1995) explained that, "Good observation skills will enable your mind to make more and unusual connections which are helpful in … creative thinking"(P125). Based on my observations in the design classroom, students working on the computer often tend to forget the elementary stages of design, i.e. conceptual roughs showing layout/composition, balance, tone, shape, and colour. Juster (1999) feels that drawing and design go hand in hand as "It helps to put your ideas onto paper so that you can actually see what it looks like. In your head it definitely looks a lot different from what it does on paper...it sometime doesn’t come out as you expect it to." (P115)

For me, drawing is imperative to the design process as it involves the ability to look, to see and to record and relates to our visual perceptual brain processes. My belief is that everyone has the ability to draw and can be taught to draw. Drawing relies on learning to see. Drawing is important as it encourages students to see things in a different way, especially if something mundane is placed at a different or unusual viewpoint.

"I have learned that what I have not drawn, I have never really seen, that when I start drawing an ordinary thing, I realise how extra-ordinary it is, sheer miracle." (Frederick: 1973, in Edwards: 1999: P4)

Swann (1997) posed the question, "Is drawing the only way in which we can expand our ability to see?" (P11) When photographing my subjects for this study, I have used the same perceptual skills that I gained from drawing. Like drawing photography helps me to learn how to see things freshly, to see relationships, patterns and possibilities for new combinations. When I draw or photograph a subject it helps me to look at it more intently and actually see rather than just look. Both encourage my perceptual knowledge as I observe the edges, the spaces, the relationships, the light and shadow, and the whole or gestalt.

For this study instead of drawing, I have used the camera viewfinder to capture images that explore and discover new visual information. My compositional knowledge has been used when looking through the viewfinder of my camera. The viewfinder frames the view and acts as the canvas, or paper, upon which one draws or paints the image.
Compositional Techniques

Composition within the picture plane is used in a way to draw attention equally from one clue to another or to direct us toward a central focusing element. Through the fragments of this image we can reconstruct a scene. My aim, in this study, was to create ambiguous photographic imagery, by using compositional techniques such as distortion, repetition, magnification, different viewpoints, decontextualising and tight cropping of the image. A source of inspiration for my work was Moholy-Nagy. Moholy-Nagy, a teacher at the Bauhaus, produced photograms recording ‘light manipulations’. He felt that, “the photographer creates with light and photography is the organization of light.” (Hight: 1995: 74) Moholy-Nagy used compositional techniques to create illusion and ambiguity within his images, as did Man Ray and the surrealist, Salvador Dali.

“To emphasise formal elements, Moholy-Nagy used techniques to separate objects from their natural settings: disorienting viewpoints, radical cropping, strong figure-ground relationships, compositions orientated on the diagonal.” (Hight: 1995: 97)

By eliminating the horizon and any other spatial or contextual frame of reference, Moholy-Nagy removed the image from its background, thereby reducing its recognition to a minimum. Hight explained that, by using asymmetry, the lack of horizontals and verticals, patterns of light reflection and textures, Moholy-Nagy, “transformed a mundane, even unpleasant object into a sparkling study of light reflections in which he forces us to participate actively in the image.” (104)

Compositional technique relates to the knowledge of basic visual elements within the image composition, for example, shapes, lines, and colours. I wanted the components of my images to be interpreted and appreciated by design students in ways that advance thinking, decision making, communication and learning. To this end I used visual design devices such as enlarging, rotation off the axis, close-up shots and cropping the image tightly to make the objects fill the compositional space. This helped to decontextualise the item. Enlarging the image magnified detail, and when an image was cropped tightly, emphasis was placed on light and coloured shapes. By enlarging detail the reality of the physical world was heightened and the objects became ambiguous.

Optical Illusion and Ambiguity

In December 2005, I visited a fascinating exhibition, “Eyes, Lies and Illusions,” at the Hayward Gallery, London. It was based on optical illusion objects from the Renaissance to the present day. The exhibition showed the power of optical illusion using a range of scientific optical instruments and objects used for popular entertainment. It demonstrated the unreliability of visual perception, the relationship between art and science and how illusion continues to fascinate us. (Endt: 2005, Mannoni, Nekes, and Warner: 2004)

“By the late 17th century such sleight of hand had become part of a vast system of the knack of raising wonders through transfixing display... Optical devices played a key role in this dialectical process of joining earthly to unearthly experiences. Specifically, the technologies of projection, magnification, and transparency made it possible to permeate tangible substances with tangible light.” (Stafford and Terpak: 2001: 82)

For some time I have been using the illusory effect of light shining on transparent objects as a central theme in my paintings and design work. My images rely on the transparency shown in my mediums of water, glass and plastic. I have used magnification to enlarge details that previously I had been unaware of. Illusion as a theme has attracted artists through the ages, and inspired movements such as Dadaism, Futurism, Op Art and
Surrealism. These art movements have used illusion as the basis for their creative output. It seems to be part of human nature that we are fascination with optical illusion.

"Our mind is so avid for meaning that it will go on searching and integrating, as if it were hungering for it all the time, ready to devour anything that can satisfy this need once it is aroused." (Gombrich: 1977: 289)

Illusion is a perceptual encounter that misleads the mind. Jan White explained that, "anything we don't quite understand arouses awe and wonderment in us." (Newcombe: 1984: PX) This desire to solve visual puzzles, the hidden message within an image, is important to graphic design as it becomes a means of attracting attention to a piece of work – visual trickery as it were. Illusionist imagery draws viewers because they are not sure what they are looking at. They are intrigued, so they look more closely. Image making is a method for designers to create visual communication. (da Pos in Sivik: 1996: 114-118) The only way to make sense of the experience is to examine more closely, yet that perspective is never complete, always shifting and changing as a result of the relationship between vision and comprehension, perception and thought. (Burnett: 1995) Optical illusion is therefore a perfect vehicle to encourage creative reflection and the images in my study have been composed with this goal in mind.

COMPONENTS PROVIDING SPECIFIC IMPETUS TO MY PROJECT

Light

Over the past four years I have explored the effect of light on and through water. I have produced a body of work in the form of photographic images demonstrating surfaces under strange light conditions using design compositional methods to achieve visual impact. In order to get a fuller understanding of why we see things as we do, there was a need to understand some of the physical properties of light. Light is, after all, that which enters our eyes and causes us to see.

Before commencing my image making I needed to refresh my understanding of the properties of light. I was not concerned with physics, chemistry and the scientific approach to light relating to such occurrences as the angle of reflective incidence, spectacular and diffuse reflection, or virtual images reflected in mirrors. It is well known (Livingstone: 2002, Varley: 1980, Verity: 1998) that white light is colour, and that light contains many rays, such as radio, infrared, cosmic and x-rays, our eyes cannot see. My work did not go into scientific explanations of light and colour phenomena as discovered by Sir Isaac Newton, rather this information was used to convey optical effects that helped me to create visual images. My interest, however, was in the optical phenomena of light. Verity (1998) stated that optical phenomenon was, “the ways in which the spectral composition of white light is changed.” (P56). When looking at the properties of light I concentrated on the optical phenomena of reflection, refraction, interference, diffraction and dispersion (scatter). I have used the conduct of light reflected and diffracted through glass and liquid, and the affect of refraction on colours and shapes and how this can affect our perception.

Plato, in the fifth century B.C, felt that light interacted with the eye and created sight, or that a change occurred between the source of light and the object struck by its rays. It was not until the mid-1600s that the Greeks' theories of light were questioned. Robert Hooke, an English physicist, suggested that light was made up of waves. Isaac Newton claimed light was a continuous wave, composed of tiny particles that radiated out from sources of light. Albert Einstein, in the early twentieth century, proposed that light was
made of rays of small areas of energy, called photons. Today, a combination of the wave theory and the ray (photon) theory are accepted as correct. (Burnie: 1992, Morris: 1979, Wagner: 1979)

When light strikes an object, each ray, or wave, is reflected off the object in many different directions. Those that reach our eyes allow us to “see” the object in question. (Williamson and Cummins: 1983) It is well known that white light is colour, and that light contains many rays, such as radio, infrared, cosmic and x-rays, our eyes cannot see. The phenomenon of light is fascinating, addressing light scatter, polarization, absorption, transmission, fluorescence, phosphorescence, ultra-violet light and other phenomenon such as rainbows.

When looking at the properties of light I concentrated on the optical phenomena of reflection, refraction, interference, diffraction and dispersion (scatter). Remarkable colours may be glimpsed from a diffracted spectrum in droplets of water or in a film of oil on dark surfaces, such as wet asphalt roads, or in the wings of a cicada or dragonfly. Diffraction is similar to interference colour effects, occurring when two or more beams originate from the same source and interact with each other. Interference, however, has a different emphasis; it is the spreading of a light wave as it interacts on itself and can be observed in perspex, glass, bird feathers, fish scales, insect wings or mother of pearl.

“The colours seen in soap bubbles originate in interference, due to light falling on a thin film of water at the top of a bubble and at the same time the light is also falling on the bottom of the bubble and is reflected from both surfaces.” (Verity: 1998: 56-60)

As my study is all about light and its properties when shone onto and into matter it seemed natural to look at, and to document these properties. I took photos under varying light conditions, both natural and artificial. Each light effect was selected for its ability to add impact as well as to convey a specific property of light. When taking photos using natural light it was obvious that sunlight varied at different times and these variations of light had an impact upon my image making. I became more aware of light as I took my photographs. I documented light at different times of the day, at different seasons of the year and in different weather conditions. During the day, bright sunlight created hard shadows and strong contrast, whereas hazy sunlight created softer shadows. Front light allowed bright colours to stand out, however it allowed little texture, as shadows fell behind my objects. Sidelight brought out shadow, texture and depth, however it sometimes caused too much contrast, while back light created silhouettes. At noon, on a sunny day, the shadows were short and dark. Late afternoon light was diffuse and the sun golden yellow, while at sunset the sun was golden or a red disc, and the light was more diffuse and hazy. However at sunrise, the light formed long shadows, and was sharp and more lemon yellow due to the angle of sun. In overcast and rainy conditions there was little or no shadow and low contrast, while the light was soft and colour rich. In winter the light was a cooler yellow with a bluish cast.

Light as Colour

Color is the thing we notice most about light in the world around us. The reason we see colours the way we do, has to do with light. Color comes from the visible spectrum of light. This spectrum goes from red to orange to yellow to green to blue to indigo to violet, all the major colors of the spectrum, and everything in between. The psychological, emotional and aesthetic response to colour is highly complicated and has been explored by many writers on colour and perception. Mixtures such as paint and inks create additive colour. Many differing varieties of light such as sunlight, neon light, candle light and so on, plus the amount of light present in the area, can also make colours appear different.
Subtractive colour is formed when coloured lights are overlayed and revert back to white light. Colour primaries are different and are dependent on who you ask, whether it is a printer, photographer, philosopher, neurophysiologist, psychologist, painter or graphic designer. (Elkin, 2000)

Research has shown that colour and luminance carry different types of visual information. Colour provides a bridge between art and science in the area of colour perception. Artists and designers use colour and light to create feelings and illusions. (Livingstone: 2002, Sharpe: 1974, Birren: 1961)

"The turn of the century (1880-1890) produced painters of great power and confidence in the use of colour. The colour relationships of Munch, Nolde and Marc were marvellously composed to enhance the emotional impact of their Expressionist paintings. The colours of Leger were almost violent; those of Vlaminck highly dramatic and those of Kandinsky charged with emotion. Matisse, Bonnard and Derain composed with acute sensitivity in brilliant counterpoint of complementaries from fully saturated to palest hues, in a superb balance of colour that delighted the sophisticated eye. These painters had absorbed intuitively from the paintings of the Impressionists and their followers the colour values those painters had achieved intellectually from their study of the various scientific writers and from each other. They arrived at a new, lyrical synthesis of colour." (Verity: 1998: 144)

In Germany, a new style and energy in the teaching of colour was initiated by a group of painters at the Bauhaus in 1919-1933. However, after the destruction of the Bauhaus by political opponents, Kandinsky, Albers, Klee, Itten and Moholy-Nagy left Germany and spread their knowledge abroad. They influenced 20th century painters such as Pollock with his textural splashes of colour, Riley with her Op-art optical mixes of pure colour, the Constructivists with their use of kinetic optical devices such as coloured glass, mirrors, and steel which "combine with motion and illumination to create a world of illusion, which involves the participation of the observer." (P147)

Water

"We need water to live and it is an important everyday physical substance, but it is also a science in itself." (Davis and Day: 1961: 12) Water exists in three states – frozen, liquid and vapour. Snow, ice, sleet, frost crystals and hail evidence the frozen state of water. The liquid state of water is shown by rain, which in turn can form vast expanses of water such as ponds, rivers, creeks, lakes and oceans. Vapour, the third state of water, exists as cloud, steam and fog. When water vapour hits a colder surface the vapour reverts to water drops.

Some of the properties of water are: absorption, adhesion and cohesion, surface tension, buoyancy, capillary action, condensation, viscosity, evaporation, magnification, refraction, reflection, and transparency. Observation of the world around us provides abundant evidence of such properties - for example, an insect walking on water (viscosity), droplets inside a saucepan lid (condensation), the ice halo around the sun in winter (refraction). (Elkin: 2000, Henderson: 2004, Stone and Ingmanson: 1970, Seavey: 1998) "The properties of water are natural phenomena and are worthy of exploring in a visual way..." (Davis and Day: 1961: 10) With these properties in mind, I have included images of water flowing, waves breaking, water droplets, rainstorms, the ocean showing silvery sunlight and the darkness of depth, mist and fog, clouds, bubbles and foam in various mixes.
Glass

It is not known where and when man first learned to make glass, but “...we do know that the ancient Egyptians were making glass articles as early as 2,600 B.C.” (Kolb and Kolb: 2000: 812) Over the centuries there have been many skillful glass artists from Egypt, Syria, Greece, Italy, Germany and France. During the 19th and 20th century many glass factories arose, such as Waterford, Orrefors, Baccarat and Murano, employing unnamed artists to create art glass. Only a few individual artists such as Tiffany and Lalique were known. As the 20th century progressed the number of individual artists specializing in glass as their medium increased. During the 1970s and 1980s, many college-level glass studio courses appeared. (Klein: 1989, Kolb and Kolb: 2000) One of the artists who studied at this time was Dale Chihuly. His work represented a complete break with tradition and a new freedom in the world of glassmaking.

The properties of glass relate to its thermal, optical (magnification), electrical and chemical characteristics. The optical property of glass is of particular interest to me in this study. When looking through glass, the glass acts as a lens. Magnification can create distortion of an object when the object is viewed through the glass. I have used the optical magnification property as a technique to abstract my photographs.

There are many of types of glass. The most familiar and widely used is soda-lime glass, the material in windows, bottles, jars, and light bulbs. Lead glass, another type, which has a very high refractive property, is softer and easier to cut, engrave, and polish. It is used to make fine crystal and cut-glass objects. Heat-resistant glass is used to make oven cook tops, cookware and most laboratory glassware. Shatter-resistant or safety glass is used for shower screens, windows and car windows.

Special glasses are made by adding various ingredients to the glass when hot or sometimes by treating the glass surface. Coloured glass is usually obtained by adding a metal oxide. For example manganese dioxide gives glass a violet color; cobalt oxide turns it blue; and chromium oxide makes glass green. Opal (or milk) glass, is transparent when molten, but becomes cloudy when it cools. Frosted glass is obtained by etching the surface with hydrofluoric acid, giving the glass a satiny look. Sandblasting creates a similar effect to frosted glass, but it tends to give a rougher surface finish. Patterned glass, such as water-ripple glass, is formed when hot glass is forced between rollers. (Kolb and Kolb: 2000)

In my study I used a variety of types of glass. Soda lime glass used to make vases and drinking glasses was perfect for magnifying flower stems and bubbles. Shatter-resistant glass helped me to capture images of amazing refracted crazed lines. A coloured glass window was used to throw colour onto glass jelly moulds. Patterns in glass, when enlarged, form the basis for some of my images. In an effort to show an abstracted image, I shot photographs through molded glass bricks.

Plastic

Plastic is a man-made chemical material produced from a combination of polymers of organic compounds. Plastic's chemical characteristics are solubility, resistance to chemicals, thermal stability, permeability and stress cracking. Impact resistance, the refractive index, and specific grades are regarded as the mechanical characteristics of plastic. (London Metropolitan University- Polymer Centre: University of Cambridge, Dept of Chemical Engineering) I am not interested in the different type of plastic such as nylon, PVC and polythene. I am only interested in the visual properties of plastic that include
transparency and opaqueness. My specific interest in this study is in the transparent properties of plastic – similar to glass. (Roukes: 1974) For example, car headlights and taillights are of particular interest to me as the light obviously shines through patterns in the plastic. A multitude of repeating shapes are reflected in the moulded plastic casing of car headlights and taillights.
SETTING THE SCENE
Setting the Scene

In the middle of the twentieth century, Kepes (1956) in his book, *The New Landscape in Art and Science*, wrote not only on scientific space photography, but also on the introduction of coloured film, black and white television, and the proliferation of billboards on the side of American highways. He felt that we were 'bombarded' by images. John Culkin, director of media studies at the New School for Social Research, NY, writing in the 1970s, twenty years later, stated that,

"The buzzing confusion of media and messages of all kinds threaten to overpower and stultify our senses and our psyches. We must develop powers of discrimination, selectivity, and expression to control and to counter the one-way spate of images and sounds which constitutes our communication and our ecology, the environment of our senses, our emotions, our minds." (Culkin: 1977: 3)

Today we seem to be surrounded by a vast expanding array of visual imagery arising from new technology: computers, colour television, DVDs, films, computer websites, ipods, billboards, magazines and print material. Ann Michael writing in *Vision and Textuality*, (Melville and Readings: 1995) found that we suffer visual fatigue as the eye quickly becomes tired of too much visual stimulation.

There are certain sights in nature that overwhelm by their first impression. The BBC nature documentaries by David Attenborough manage to capture and record these amazing feats of nature. The latest series, *Planet Earth*, (Lindfield: 2006) showed many amazing images of light and water. Underwater views and animals immersed in water displayed many variations of the properties of water. A foot long banana shaped bud from the African Baobab tree, unfurled in one minute, at night, like magenta ribbons of satin with a starburst centre. These and other amazing images opened my eyes to views that I could not capture. However, I began to more deeply appreciate the beauty in the natural things of the world, in particular the play of light and shadow.

Pictures are everywhere. Left uncaptured, these moments are likely to be forgotten, recorded they are preserved and remind us about important and interesting events. It is not necessary to travel to exotic locations; images are in our own house, our backyard and our surroundings.

My reading has made me understand that all artists, designers and photographers rely on light. They produce creative solutions that vary according to their particular interest in light, for example Monet and the Impressionist painters were concerned with light at certain times of the day and the seasons, whereas Moholy-Nagy and Man Ray were interested in artificial light and pictorial composition. For me, sharing a personal vision and seeing something ordinary in a new way is thought provoking, while sharing the observation through a photograph is exciting.
INSPIRATION

Light in art

The French and Australian Impressionists’ use of light and the simplicity of their mark making have been a significant influence on my image making. My interest in the phenomena of light and refractions was sparked years ago by Claude Monet’s painting Bathers at La Grenouillere, (1869). It showed such simplicity of form and shape, yet emitted a luminosity and radiance of light reflecting off water. In comparison the painting of the same scene by Renoir - La Grenouillere, (1869) seemed dull and uninspiring. His softer brushstrokes and weaker colours did not seem to convey the same feeling as that achieved by Monet. The photographic process, invented in the 1830s, was a strong influence on these painters (Heilbrun in Green: 1997). Two visions by the Australian Impressionists painters, Arthur Streeton and Tom Roberts, painted at the same spot on Sydney Harbour have a similar feel; one is sparkling and the other lacks life, due to the mixed paint colours and the different brushstrokes. The comparison of these paintings helped me to look more closely at my colour mixing and my brushstrokes. In order to retain the sparkle and crispness of light and colour in my own paintings, I needed to keep my paints clean and untainted. The comparison of these paintings helped me to look more closely at my colour mixing and my brushstrokes. In order to retain the sparkle and crispness of light and colour in my own paintings, I needed to keep my paints clean and untainted.

Light is constantly changing, throughout each day, from day to day, and with the time of year. As it changes so do its quality, colour and direction. This phenomenon can be seen in the paintings of Monet, Cézanne and Van Gogh, which often depict the same scenes under different lighting conditions. (Myin: 2000) An example of this is shown in the work of the Impressionist painter Monet in his series of haystacks in fields, painted in the different seasons and at different times of the day. His landscapes look different in glowing light or in blanketed mist. He also painted many huge canvases of the Rouen Cathedral, such as “Cathedral in Sunshine”, (1894) and “Cathedral in Fog”, (1894), (Feldman: 1981: 150) showing majestic variations in colour and light. I first saw these paintings, years ago, in L’Orangie Gallery, Paris and was entranced by the different colours and fresh brush strokes. How disappointing to visit Rouen a few years later and see this scintillating image as depicted by Monet, as a drab brown stone cathedral due to the dull, overcast winter light. The light on a cloudy day is monochromatic; the highly diffused light diminishes contrast and enhances soft edges.

Illusion

The dream of disembodied color and form floating on a transparent ground has been a common thread in modern painting as it sought to become increasingly abstracted from matter. Marcel Duchamp, in his Large Glass, resolved the problem of suspended forms in space by inlaying metallic forms into transparent glass, but he did not deal with the problem of colour. Jackson Pollock's painting on glass was an attempt to render the support transparent so that drawing would seem to be suspended in air.

In 1993 I sat in a huge empty room and looked up at a small square patch of sky. Clouds moving across the square of blue sky created an artificial movie screen. James Turrell in his, Friends Meeting House, at the Hayward Gallery, London, was “obsessed with the artistic exploration of light and has devoted his life to demonstrating how light is something to be treasured”. (BBC World Service: 2000) He was concerned with the
subject of light as a physical phenomenon, using sky imagery to describe changes and shifts in the passage of time. Viewing his work is a form of reflection.

Abstraction

Christo and his packaging of familiar landmarks and buildings turned the known into unknown shapes. His idea of the familiar disguised to become the unfamiliar is repeated in my images by using composition as a method of decontextualising a familiar sight. Christo’s wrapping of the bridge, to create a repetition of shapes is displayed in “The Pont-Neuf” (1975) and “Valley Curtain” (1971-72), showing unfamiliar colour contrasts through the use of a huge orange curtain strung across a canyon. (Read: 1974: 321) Edward Wadsworth, a member of the Vorticism school of artists, painted large abstract shapes on the hull of warships. This was used as a method of camouflage by the military. (Tate Gallery online) “The red tree” (1911) and “The horizontal tree” (1911), paintings by the DeStijl artist Piet Mondrian show the abstraction of a tree form using nothing but horizontal and vertical lines and separated planes of primary colours in flat tints of red, blue and yellow. (Read: 1974:194-5) The lines simplify the structure of the tree and yet the eye still searches for what we recognise. Modernism was the beginning of simplification and expressionism. (Ferrier: 2001) Art movements such as Dadaism, Futurism, Surrealism and Op Art have used illusion as the basis for their creative output. To create abstraction in my images I have magnified objects in order to simplify shapes, as well as using compositional techniques to decontextualise an object.

Light on glass

Dale Chihuly, a glass artist who radically transformed perceptions about the medium of glass as he tried to avoid the objects of traditional glass making, stated that he was, “involved with the glass and the light that passes through it - the phenomena of light being transmitted through coloured glass.” (Chihuly: 2002) Walking under “Persian Pergola,” (1998) Chihuly’s illuminated ceiling of coloured glass composed of many oddly shaped transparent forms at the Australian National Gallery exhibition (1999), was amazing and awe inspiring. His views on colour, light and glass encapsulated my own. His large spotlight coloured glass objects on plinths cast amazing, stimulating shadows. Cowart (1997), when talking of Chihuly’s glass making, stated, “We are held captive by the spell of this contradictory world where hot colours are frozen in impossibly thin fused silica re-animated by strong light and shimmering reflection.” The transparent medium of glass fascinated me, and the overlaying of transparent colour produced an intensity of colour and depth. Shaped and textured glass created distortion as the glass acted as a concave or convex lens. I have been inspired to use Chihuly’s techniques to create distortion, which in turn increases abstraction through ambiguity and illusion.

A huge influence on my work was the discovery of a book, found in an academic remainders bookshop in London in 2001, on the American artist Janet Fish. After working in the area of colour, light, water and glass for the past sixteen years it was incredibly exciting to come across an artist working within these same boundaries. Fish explains that, she paints “through the painting.”(Henry: 1987: P42) Her amazing works show reflections in glass bottles, cling film stretched over red capsicums and layers of coloured glass plates, “showing a shimmering flow of various shapes.” (P38) Reflections of buildings in the background are included in her paintings of rows of glass bottles arranged to show a multitude of refracting layers of glass and liquid creating amazing coloured shapes. Her paintings made me more aware of the abstract qualities that can be achieved when glass, coloured glass and water are layered-on-layer creating multifaceted shapes of colour.
Light on water

Water as subject features strongly in the work of many artists I admire. One is Monet.

“Water always held a fascination for Monet. In its transparent liquid density he saw a tangible materialisation of that invisible air that bathed the nature he painted. Water became liquid air. The ever-changing states of water, like a flexible optical system, helped Monet and his colleagues to see the structure of light.” (Liberman: 1988:18)

Henri Matisse was also drawn to paint water. In Tahiti he discovered the “…spectral shimmer of the underwater world…looking first down into the clear lagoons and then up through levels of water toward the sky.” (Cowart: 1997) Peter Doig in Blizzard Seventy Seven (1998) showed examples of water reflection in his paintings and film stills in his exhibition held at the Whitechapel Art Gallery, London. In 1998, I discovered Chagall’s stunning stained glass windows in a tiny village church at Tuddley-cum-Capple, UK. The windows were dedicated to the memory of a young girl who had drowned in a nearby river. The flowing blue lines of water depicted within the stained glass, interacted with the lead lines supporting the glass pieces, to form abstract swirling shapes. It was a double delight, as the windows were not only depicting water but were also transmitting light. This experience made me more aware of light and the layering effect of transparent colour on transparent glass. An examination of previous images using water, in the work of Hockney who divided water ripples into overlapping lines, helped me to look at water as a lens. (Stangos: 1980, Hockney: 1980: P29-57) This knowledge gave me an advantage when photographing flowing abstracted shapes formed by the figure in water.

Photography

When the camera was invented in the 1830’s, it was used to document family portraits, events and social injustice. (Miller: 1974, Kismaric: 1990). Artists of the time used the camera to record concepts for their paintings. For example the Post-Impressionist painter Toulouse-Lautrec, photographed bars and prostitutes while Degas captured images of ballet dancers and racehorses. (Heilbrun: 1997)

Photography was regarded as both an art and a science. (Miller: 1974) In the 1900s the military used scientific aerial photography to map war zones in both world wars. Scientific interest was also aroused with the advent of microscopic telescopic photography in space. Hight (1995), stated that, "the scientific photograph pointed to a new way of seeing the world and, in the process, evoked a sense of amazement about hitherto unseen aspects of it. However, this new seeing form is something very visual, formal, and abstract". (P185)

Artists such as Moholy-Nagy, Kepes, Man Ray, Lissitzky, Duchamp, and Rodchenko, along with the surrealist, Dali, appropriated scientific photography for aesthetic ends. (Hight: 1995) Lissitzky often made parallels with science, mathematics, engineering and biology. The modifications of light is part of the technological and formal process of photography

Moholy-Nagy, an educator at the Bauhaus, was influenced during the period from 1914-1930, by Russian constructivism and the diagonal axis of Russian painters Malevich and Lissitzky. The Russian photographer Alexander Rodchenko paralleled Moholy-Nagy and was an influential force in many ways - they both used unusual camera angles; contrasts, plainness and repetition of forms contributed to an impression of order and solidity. Moholy-Nagy published a picture book titled Painting, Photography, Film, which illustrated
the many ways in which photography challenged old habits of seeing. He wrote, “The photographic camera (can) make visible existences which cannot be perceived or taken in by our optical instrument, the eye.” (Ades: 2000:13)

“Having defined photography as the manipulation of light on photosensitive materials, he explored how to use light creatively as a medium while simultaneously having his technique refer to recent scientific theories of bodies moving through space. His method of working eradicated boundaries between the abstract and representational, between the artist’s creativity and the seemingly objective, documentary nature of the camera image. He probed the manner in which the value of a photograph changes as the context for its viewing changes. …. Moholy created a body of work marked by a singular vision, photographs that are at once daring, analytical, mysterious, provocative, and aggressively modern.” (Hight: 1995: 6)

Moholy-Nagy was most imaginative when using the inner city as a setting at night, with its traffic lights, advertising signs and car lights. He suggested the use of light to render space, time, and movement in non-static art. Moholy-Nagy, “aimed to address the definition, direction and role photography could play in the renewal of perception by constructing a new language of seeing.” (Hight: 1995: 99) For Moholy-Nagy microscopic photography, close up enlargements, long exposure, x-rays, and the instantaneous arrest of movement were the beginning of “objective vision.” His work in the 1940s marked the beginning of ‘abstract’ photography, which was to establish itself only a decade later alongside abstract expressionism in painting. (Fiedler and Moholy-Nagy: 2006)

The photographic work of Moholy-Nagy influenced the interest of Marcel Duchamp and Salvador Dali in photography and illusion. Duchamp understood mathematics and maintained an interest in science, optics and perception throughout his life. He developed a series of twelve spinning discs called ‘Rotoreliefs’ which produced the illusion of volume or relief. (Shearer and Gould: n. d: 3) It was thrilling to see how he controlled and manipulated light when viewing his Rotoreliefs displayed at the “Eyes lies and illusions” (2004) exhibition at the Hayward Gallery, London. Dali on the other hand perceived the amazing new world provided by such photography, as part of a “new poetic medium” which would capture the “most delicate osmoses, which exist between reality and surrealism.” (Ades: 2000: 13)

Salvador Dali, a member of the Surrealist group, used photography to explore visual perception and the way optical illusion affects our sense of reality. This interest in optics bought his art into the area of science; however, he was, “deeply sceptical of the claims of rational science to explain the real.” (Ades: 2000:11) In his paintings he introduced a precise balance between reality and surreality as he experimented with perspective distortions. As Dali explained, “A simple change of scale provokes unusual similarities, and brings out existing –though undreamt of-analogies.”(Endt: 2000: 13) His interest in photography and surreal illusion can also be seen in the work of Man Ray.

Perceptual ambiguity in photography is now recognized as a visual art technique. Man Ray’s Astrolabe (1957) shows the bizarre capacities of light and optics, displaying reflections bouncing off hard surfaces. This effect resembling, “… the conjuror’s ball, invites the spectator not only to look into or through or around the image as well thus freezing space and time … Man Ray sweeps together the fragmentary dispersal of post modernity.” (Stafford and Terpak: 2001)

Man Ray was greatly influenced by Duchamp, a close friend and associate, as they shared an interest in minimalism and abstraction. Man Ray experimented with what he termed “rayographs.” Placing a three-dimensional object or series of objects on top of a piece of photographic paper and exposing it to light basically formed these rayographs. Man Ray stated, “I do not photograph nature. I photograph my visions.” (Surrealism, Revolution by Night: 1993)
Gyorgy Kepes, a design educator, was fascinated by new discoveries in science due to microphotography. During the 1950s, Kepes and a group of scientists and artists produced an exhibition of scientific photography showing images that became works of art in their own right. His idea of educating people to see the ordinary in a new way is still being used in design education today. (Kepes, 1956) His views have been an inspiration for my work. Often, what "we overlook or disregard, the mundane, the ordinary, becomes a source of inspiration to the artist’s eye." (Eisner: 1972: 12)

“The camera shutter shows a superiority over the selectivity of our seeing. By holding movement and freezing time, the camera isolates that small detail that is not seen by the eye, and, by making the invisible visible, creates a permanent record we can examine at our leisure.” (Walker: 1988: 5)

The camera can only provide a flat two dimensional simplification of a scene. The camera loses all sense of distance; this is due to our eye seeing differently to the camera. We see visual cues, such as colour tones, overlapping shapes and diminishing size to help us sense perspective. Our eye can see detail in shadows and in brightly lit areas, whereas the camera cannot discriminate. Our eyes move all the time and every movement of our body changes our angle of view. Much of what we see is missed in a glance and without concentration, much escapes us.

Photography is the basis of my image making and I have used the camera to capture and abstract natural phenomena. Photography had the capacity to lay bare the hitherto unseen and unimagined. I used the technical side of photography to achieve precision and clarity, and the split second shutter speed to capture a specific moment in time, as the camera is capable of "snatching an ephemeral order out of a succession of instants from the confusion of competing phenomena." (Stafford and Terpak: 2001: 67)

**Digital photography**

Digital photography is instant photography; it gives us the ability to see an image instantly as the process of taking a photo is reduced to pressing a button, then pressing another button to see the captured image on screen. Instant photography has come a long way since 1947, when Edwin Land introduced the first instant Polaroid prints. Peggy Sealfon (1983) was correct when she predicted that, “Perhaps image making of tomorrow will be a symbiosis of instant photography and electronic imaging systems.” (P17) Today we have instant digital cameras and computer software programmes such as Photoshop to manipulate photographs, and printers to print the final photographic image.

The simplicity of operation of digital cameras makes them easy tools to use. Any tool is only a means to an end and in this study my tool was my camera. The latest digital cameras are simple to use and yet they are based on sophisticated electronics and technology. The satisfaction of ‘taking’ and ‘getting’ a picture simultaneously had tremendous attraction for me, and the thrill of seeing my photograph in a matter of seconds was both exciting and appealing. The act of pressing the shutter was so important that my intuition about the intended result was vital. A moment was seen, suspended in time and then displayed within seconds and a slice of reality had been saved. The French photographer Henri Cartier-Bresson, commented that, "Photography is the simultaneous recognition, in a fraction of a second, of the significance of an event as well as of a precise organization of forms which give that event its proper expression." (P24) The chance to compare my picture with the reality of the scene photographed proved to be an invaluable learning experience, establishing composition and helping to increase my sense of observation. My digital camera provided instant feedback, with its ability to edit, keep, delete or re-shoot, and this accelerated my learning process.
Taking digital pictures and creating instant images motivated me to see the unexpected in the everyday. I set out to take pictures that I had never seen before. By using a camera with a macro or telescopic lens, it was possible to show an object in an extreme close up view. My camera lens had an incredible ability to show close up details, similar to that of a macro lens. Details can reveal a great deal about a subject and close-up views often can make a difference between a mediocre image and a superb one. Sometimes my results were unpredictable, since there was no way of knowing precisely what might present itself in front of my camera, but of course the final choice was mine.

“A photograph need not merely document reality but can abstract a real object to reveal an unusual facet or pattern that catches the photographers eye. The object itself becomes almost insignificant, as emphasis is placed on its colour, shape, or form….taking pictures of patterns and reflections is an exciting way of exploring the physical world and seeing things in new ways.”
(Sealfon: 1983: 112)

By using a restricted framework like the properties of light, water, glass, and plastic, I was forced to explore the situation thoroughly. A wide variety of photographic effects were achieved by concentrating on my restricted subject matter. Working with a digital camera enhanced my appreciation of nature by forcing me to examine a scene in two ways, through my own vision and through the camera lens. The visual impact of my photographs depended on the particular aspect that was isolated, and thus selection was the key.

Computer manipulation

Previously, much time would be spent after taking a photograph to process it - to chemically develop the film, produce contact prints, select the best image, and then print the final copy. No longer do we have to wait a week for processing. Today, due to digital technology, producing a final image takes much less time. Digital images are downloaded onto the computer and software programmes, such as Photoshop, give instant responses. Computer programmes are available to manipulate the photograph, giving the operator precise control over the final composition, colour and contrast. I have used the computer to enlarge and reframe my composition, and also to correct colour and contrasts. I have not used further manipulation such as filters, layers or textures, as I wanted to retain the natural feel of each image.

MY ART AND DESIGN PRACTICE

My formal training was in graphic design, visual art and education. I feel that I belong to group of graphic designers who were really frustrated visual artists. However this trend may have changed with the advent of the computer, as many hand skills are no longer taught. To me, hand skills or “getting one’s hands dirty” is a major part of the visual art making process. My aim has always been to sharpen my observation skills by using an inquiring eye to look at everyday items and the wonders of nature around me. I have sought to see more in the minuscule particles of nature, to discover something anew in the wonder of our environment.
“Research means looking - and looking again” says Ann Bertoff. “This new kind of research would not mean going after new data, but rather reconsidering what is at hand…we do not need new information; we need to think about the information we have. (Bissex and Bullock: 1987: 4)

As a design student my father set up my dark room, in our laundry at home, using black plastic stretched over a frame to block out the light from the window. The developing and fixing trays were set out on our washing machine. During this time I consolidated my skills and began to develop my own vision.

Over the years my visual art images have been paintings produced in oil, acrylic, pastel and watercolour. The discovery of the wonders of light, glass and water arose during still life watercolour painting. The work of Harold Herbert, an early Australian painter, influenced my watercolour paintings. (Burn: 1990) I was particularly impressed by his painting of purple tree roots seen at an art auction at Malvern, Victoria. I was astounded by the fluidity of the watercolour paint and the unusual use of the colour purple to depict tree roots. I eventually bought one of his paintings of a country cottage. Unfortunately the colours are rather dull in comparison to the sparkling closely cropped tree roots. I still regret not bidding for this painting, as it remains an influence on my image making.

For a long time my main medium was watercolour. One of the methods of watercolour painting is layering. White is the paper and colours are added in layers starting from light to dark. To avoid the wet colours mixing, the painting is broken up into small stages and analysed. Colour may be painted into shapes or overlaid onto dry colour. Patience is needed when painting with watercolour; the layering technique created the need to wait while wet paint areas dried. However, waiting allowed time for reflective thought and to really see the details of the painting. While observing my paintings in fine detail in this way, I could analyse where to place the next brushstroke. It also gave time to wonder at the way the lens of water and glass can cause distortion and refraction. I became fixated on the colour and shapes that formed. The refractive and reflective properties of light in and on water, colour and glass hold a fascination for me. I am constantly looking at light effects in water and glass, such as reflections in glass covered multistorey buildings and shop windows that reflect a moving image of people and traffic. When walking past a shop window we all seem to need to look; is this the voyeur within us or is it the need to reassure ourselves that we are still visible? By looking into the bottom of wine glasses or heavy bottomed glass vases we are able to see distorted objects due to the thickness of the glass acting as a convex or concave lens.

The subject matter for my watercolour paintings came from the domestic world around me. I set up arrangement of flowers and inexpensive items collected from overseas travels, junkyards or trash and treasure markets. The still life was placed outdoors to get the benefit of intense sunlight. It was moved and rearranged to gain the maximum lighting affect, with as much reflection and refraction as possible. Objects were placed on mirrors to gain more reflective and distorted shapes of colour, thus enabling me to explore shape in more detail. Photographs were taken and formed the basis for converting the image into a painting.

In a bid to capture the fleeting glimpse of light before it disappeared I needed to paint faster so this led to painting with oil and acrylic. When painting on canvas, restrictions are placed on the composition. The size and composition must be planned prior to stretching the canvas. Instead of painting the whole still life, I found that I had become obsessed with trying to capture the smaller areas that displayed the reflective and refractive properties of light on water and glass. The experience of seeing light playing off and through surfaces, of seeing beyond the surface, led to my desire to try to paint the effect of light intensity.

I tried to make a distinctive visual statement about common still life subjects such as glass, water and objects floating on or submerged in water. I began with a formal
approach to still life placing the objects within the picture plane. I looked at the tonal range of darks and lights, but would check the forms as I worked, interlocking the marks like a jigsaw puzzle to create the illusion of form. Colours were exaggerated, by increased saturation, to suit the large scale of the image. This helps the imagination to reinterpret the way we see things or even invent new effects within the painting.

As transparent or reflective materials, I used clear glass vases, bottles, plates, drinking glasses, mirrors cellophane, coloured glass, and water coloured by food dye. Repetition of shapes, and the layering effects of light appear to create movement through and within the object, and we can be totally drawn into seeing all the myriad shapes and forms - almost like a jigsaw puzzle. To find the form of the painting in the shapes made by the light I exaggerated colour and turned interlocking marks into coloured shapes. Within my paintings the mark making became larger so that the eye moved from mark to mark. This technique became a method of abstraction. When viewed from close range the shapes and colours were juxtaposed together, however from a distance the colour areas came into focus showing the image as almost photo-realistic. I am impressed with the freedom and spontaneity of abstract expressionism, but find it hard to conceptualise in an expressionistic manner.

Ideas for this study began to evolve while working on my still-life painting. Due to time constraints on my creative painting practice I turned to representational imagery using the camera and its capacity to capture realism.
MY PROJECT
My Project

My study involved a process of investigation, analysis, synthesis and interpretation of data obtained while investigating light when it is shone onto and within water, glass and plastic. The process involved looking for the essential qualities of light, seeing the potential in its instantaneous nature, and observing the relationship between light and form. This challenged my initial, superficial understanding of the subject of light as a whole.

I decided to use photography as a medium to investigate and record light. This would seem appropriate as “The word photography is derived from the Greek words for light and to write.” (Hight, 1995, P74) The intended outcome for presenting my photographic images showing light was to prompt my design students and other viewers of my images to engage in discussion and action to find out more about this subject. As a teacher of design I wanted students to see the light the way I saw it. From an educational perspective, I began by looking at ways to increase observation skills in my students and to tie this in with my area of interest, my own image making.

In producing this series of photographic images I wanted to explore light and to capture the characteristics of light, to document the changes that occur, for example, when light changes direction due to refractive qualities within a material or the reflective qualities of a surface. I felt that collecting and analysing my images could enhance my teaching within design education. My aim was to try to awaken a sense of surprise, a sense of wonder, a new way of looking at and talking about the phenomena of nature. My images could be used as a teaching resource to encourage design students to see the world in a fresh and creative way. I originally intended to use these photographs as the basis of a teaching aid for students of design, one that would encourage the development of design vocabulary.

At the start of my study I produced a series of images and tested out my concept on my students. I showed my students what I was doing to see if they could see the effect of light within various visual contexts. By looking at my images, I hoped that my students could be challenged to re-look at everyday occurrences and objects that surround them, in other words to become more visually aware of something seen previously. In May 2005 I surveyed my design students, collecting words used to describe my images in an effort to test the extent of their visual literacy knowledge. I found that my students could describe my images using a limited amount of design language, but they appeared to have little interest in what they were looking at and were not concerned with my reason for producing them. I had hoped to try to awaken in the students a sense of surprise and wonder, but they did not appear to become more visually sensitive or more visually aware. I became conscious that I could not force someone to see what they did not want to see. They did not see the light the way I do.

The questions raised by the student responses were not central to the research question, but they highlighted the historic problem of the photographic image – that photography has a history of being understood as a medium of realistic documentation.
Knowing this I produced my images to fit between the real and the abstract. That we find it difficult to take the image at face value, since we always want to link it to the known, is what the students tried to do – identify the subject rather than respond to the image as an object. Their response confirmed the literature, which meant that my research into the object values of images produced through the application of design methods remained valid.

This made me reflect on my work and to question myself as to why and how I view light. As a result of considering these issues, I reframed my objectives. I realised that my images were a part of my own personal quest. I was the one who had awoken to a new way of looking at and talking about the phenomenon of light and I wanted to explore and document my personal response. I resumed my project with a renewed confidence and purpose.

As my purpose became clearer, my concept changed, I now wanted to show images that had special meaning for me, to interpret and re-present moments of light in a specific way. The concept of light is filled with a multitude of interpretations, ideas and possibilities. No matter how technologically advanced we think we are, nature invariably asserts itself over our human existence. We often gain inspiration by the simple things around us. “There is a possibility that the same kind of delight of seeing that happens to me, could happen to you” (Turrell: 2000: NP)

This study became an opportunity to shake myself out of my comfort zone – to question my image making, to analyse and take on new perspectives and alternatives. Many of my decisions had become intuitive and thus unexamined.

MY DESIGN RESPONSE

I set up a project to capture light as I see it and in a way that interests me. I was concerned with the subject of light as an optical phenomenon. My specific aim was to create distorted, ambiguous and conflicting images in my photographs by using the ‘optical phenomena’ of light such as, refraction, diffraction and reflection as a basis for abstracting reality. I hoped to use light and its qualities of distortion and abstraction as a creative medium to demonstrate illusion and ambiguity. I wanted to show the unfamiliar in the familiar by capturing images of optical abstractions formed when objects are transformed by the unpredictable play of light. In particular, I sought to explore illusions created through the interaction of light with glass, plastic and water. My photographic images were a continuation of my interest in light, discovered while watercolour painting. To me light is at its most intense when shone into or onto a transparent medium. I have used glass, water and plastic as my subjects for conveying the sense of my project. I also planned to use compositional techniques as a method to focus on ambiguous qualities within my images, in an attempt to show everyday items and matter in an innovative way. In exploiting the illusional properties of glass and water in my portfolio of images, I wished to produce a creative resource that could be used in my design and art practice.

I have approached this study with the idea that observation and awareness has importance to my design practice. Throughout this research study I have tried to sharpen my observation skills by using an inquiring eye to look at everyday items and the wonders of nature around me. Instead of using obvious images of real life situations I have taken a different approach to visually communicate the phenomenon of light. I have used design compositional techniques to convey and express abstract forms. This in turn acknowledges my response to the importance of image making within the practice of design.
The framing of the field of vision, as well as the framing of the composition are important factors in the photographs in this study. My photographs are photo-realistic and they become a means of expressing a concept within a perceptual setting. I have been preoccupied with the optic qualities of vision and the manipulation and the break up of the photographic image.

Watching and waiting underpins my photography and my painting - waiting for the right circumstances, until the object, light or movement were just right. Through the lens of my camera, objects and happenings were slowly inspected. The camera was panned vertically and horizontally over the surface, showing lines within lines, fragments within fragments; this combination when added together produced new meaning.

By absorbing my experiences, my visual interpretations became a way of developing a narrative. New worlds appeared and words formed to create a personal pictorial language. I used descriptive language to discuss each category and determine what the photographs demonstrated. I then transferred my words into a glossary of language associations. This led to the realisation that my images and an added glossary of terms could still become a teaching aid for students of design. Perhaps the written descriptions of my photographs could help design students to see what I saw.

THE PROCESS

Following is an account focusing on the specific methods used to produce my series of photographic images. The intention was to find and understand the methods and techniques used to capture the characteristics of light.

My information collection took many different forms: a series of photographs, a reflective journal, interview notes and direct observations. I have written personal reactions to my material and included quotes, notes from private discussions and public seminars. I have recorded and written up the process to clarify my observations.

Many of my images came unexpectedly, for example when sitting on a beach or rock, gazing into the sea and suddenly noticing the light falling on some detail that attracted my imagination. When this sudden split second occurred I was sometimes lucky enough to record this inspirational moment from nature with my camera. There was a need to stop and record this flash of light immediately, or I might lose it. I took photographs and noted the time of day in case I wanted to return. At this stage the photographs were a purely a record, without my imposed ideas.

My work was a form of contemplation, an almost mystical experience of things happening around me as I tried to capture the extraordinary energy of light dancing before my eyes. Much time was spent gazing at a subject, especially one that included moving water, as I tried to choose the best composition in order to obtain a perfect sense of balance. This time spent watching and waiting required patience.

Equipment

Photography was a convenient medium, as due to constraints on my time I was unable to continue painting. I chose digital photography because it allowed me to view an image immediately after taking it. It was the perfect tool for capturing instantaneous moments. An added convenience of using a digital camera was its portability. I needed a camera that was small and light enough to carry at all times. I could access it quickly and try to
capture a fleeting glimpse of light before it disappeared. I also wished to take very close-up shots of the phenomenon of light. I set out to find the smallest possible camera with the fastest shutter speed and the greatest depth of field. In addition I needed to save my work at a high resolution for printing and yet still have the ability to store over 100 images. I settled on a 35mm Nikon digital camera, as it matched most of my criteria in terms of features and capacity. Some of the benefits were the automatic focus feature and a built in macro type lens which meant that I did not need special filters.

A requirement in learning to see photographically was knowing how my equipment would affect the representation of a scene. A Single Lens Reflex camera lens views exactly what is seen and gives total control over composition. My small camera was not SLR so I had to compensate when composing through my viewfinder. My camera also had other limitations, such as the automatic exposure. Although automatic exposure was a time saver, sometimes the colours varied and the contrast areas were unbalanced. The depth of field was reliant on pressing the shutter until my main object was in focus. Of course the focus could not be digitally manipulated on the computer. I had to take more photographs until I was pleased with the focus. Inbuilt restrictions such as shutter speed and automatic focus became a method of reduction. I actually turned off the flash process to provide more control, as I disliked the way it washed out the colour of the subject.

Subject matter

My interest in glass, water and plastic was the stimulus to embark on a continuing series of photographic images showing the unfamiliar within the familiar. My pictorial material arose from my surroundings. Glass and plastic objects, such as moulded glass, cut glass vases and glass bricks, were photographed in a range of situations, both in the home and within the urban environment. I did not take a broad sweeping view of the landscape and focused instead on the smaller areas as close up shots show incredible detail that may otherwise be missed. My series of photographs show the ”...ability to detach fragments for scrutiny.” (Berger: 1972: 25) Berger points out that although ”...the scientist makes the discoveries, it is the artist who is uniquely qualified to express and communicate them.”

Timeline and Study sites

This study has been a continuous journey of looking and seeing. I have been lucky to capture light in numerous sites and many different situations, thereby increasing my opportunities for image making.

My photographs were taken in a range of locations in Australia and Europe between 2004-2007. They were taken in both rural and urban sites and included interior and exterior settings. A variety of water sites (for example, ocean, beach and lake) were randomly selected. Light on water varies in intensity. On large areas of seawater it appears to sparkle, whereas on fresh water lakes and rivers there is more of a glare or sheen.

Photographs were taken in diverse weather and lighting conditions, at different times of the day, and a variety of situations. The interplay of such variables with each subject and site resulted in a wide variety of different optical effects and moods. Examples include:

- A Canberra garden on a frosty morning revealed fern-like ice crystals.
- Winter raindrops on a cruise ship on the Brisbane River, created a negative and positive counter change effect.
- A figure in a swimming pool on a hot, sunny summers day was distorted and abstracted by the water acting as a lens.
• Shattered safety glass on a Paris railway station formed crazed glass lines of light.
• A summer storm in a village in regional France created a sense of foreboding.
• Sydney Harbour at night reflected artificial light and neon signs.
• Boats, fences, and bollards were reflected in the river water at Port Fairy, on a clear sunny day.
• Mallacoota with its surf beach and expansive lake system was an ideal spot, for capturing moon circles.
• At the south coast beach of Guerrilla Bay, tidal rock pools showed light bouncing off wave ripples and refracting onto sand at the bottom.
• Water pouring down the glass entrance of the National Gallery of Victoria, acted as a lens, making figures appear bent and warped.
• In Britain, long rhythmic lines, were captured in images of ice on a pond, a running a swift flowing river and village stream.

Compositional Techniques

Composition is the way objects within the picture plane are arranged. My photographic images were composed as paintings, using compositional techniques to gain visual impact.

An optical experience relies on several technical devices such as, the angle of view, the extreme close-up and the play of light. The tools for creating illusion within three-dimensional space are: overlapping, changing size and position, perspective, hue and value, extreme angles and different vantage points, - all associated with post modernist photography. My images were composed through the camera viewfinder. The subject was looked at, checked to see that it was clearly visible, and shapes and shadows were inspected. The background was checked for odd shapes or colours that could detract from the centre of interest. Views were framed so that areas of different colour, tone and texture made clear shapes together. Varieties of texture, form and line were revealed by shadow contours from bold side lighting. I tried to find the most striking feature and became very selective in emphasising one feature that conveyed one or two properties of light. I found that simple images conveyed mood more powerfully than complex ones.

To capture the best vantage point when composing through the camera lens, it was necessary to get down to the right level and walk around the object if possible. I used shots from different directions - upwards against the sky and downwards for overhead views. Looking down allowed for the control of shadows and gave the ability to create odd shapes. Simplification of complex shapes appeared through the contraposition of images that were deflected through glass, plastic and water. I had to decide, when looking through the camera lens, whether to come in closer or to cut or edit out some of the background. I took several shots in quick succession, as light and movement changed very quickly. Photographic opportunities appeared quickly and a natural occurrence was unrepeatable. I had to be alert for surprises and to take advantage of the light.

I never used flash as this can often create a washed out effect and makes it impossible to capture translucent light shining from behind an object. I have not used props such as white card reflectors since all my images are natural and record an event. My images have only had a small amount of computer digital manipulation. They were not changed by filters or the addition of textures and so on, but were simply cropped and each image checked for contrast and colour balance.

Design elements and principles such as, repetition-pattern (continuation), colour, shape, line, tone, texture, depth-interposition, emphasis, balance, contrast-figure/ground, direction/movement, and size/scale were used to construct each image. I observed that the Gestalt theories of figure/ground, proximity, similarity, continuation, closure,
smallness, surroundedness and symmetry occurred in many of my images. When producing my photographs specific compositional techniques were used to select the most suitable examples of surfaces under different light conditions. Cropping and magnifying were two of the techniques used to help increase visual impact.

Visual design compositional devices such as enlarging, close-up shots cropped tightly so that the object filled the compositional space, helped to de-contextualise the subject. On the computer my images were further enlarged. By enlarging the image it magnified detail and when cropped tightly, emphasis was placed on the coloured shapes. By enlarging the detail, the reality of the physical world was heightened and the object became ambiguous. Using this illusionist technique became a method of forcing the eye to try and decipher what the object may be.

The unique properties of light, such as the effects of refraction, dispersion, diffraction and reflection, also helped me to create abstraction through illusion and ambiguity. These properties have been used in their own way, as another technique to distort and thereby abstract my images. This method helped to create abstraction through and visual chaos. I have used illusion and ambiguity as a technique to increase visual impact by forcing the viewers’ eye to look and try to decipher what the object might be.

**Glossary**

My glossary will help to explain the words I have used to describe my images. My words are my visual language. This visual language is valid across all disciplines of art and design; it remains constant and underpins all works of art and design. It is fundamental and will not change with a new style or the use of new technology. I have, however, included words to describe the circumstances of my images. These words describe my images in terms of optical phenomenon as all my photographs demonstrate scientific terms relating to the properties of light such as, inferior and superior reflection, moon circles, as well as an explanation of the refractive index of light. A variety of lighting effects are detailed, diffusion, dispersion, interference, luminosity and translucency. Light and colour are described using terms such as spectral and prismatic colour. Different types of glass are clarified for example, beveled glass, ripple glass and laminated glass, as well as the opacity and transparency of glass. When creating distortion it is necessary to know the difference between concave and convex glass lenses. The properties of water are such as precipitation; surface tension and capillary action are made clear.

**Analysis and selection**

Light is fundamental to what we see, and it is reasonable to use its physical properties as the basis for my study of the images, which can result when light is shone on and into water, glass and plastic. My images captured the vast differences when light is shone onto and within these media. I chose to use the properties of light as a means of focussing on specific areas of light. I reduced my field of interest by dividing the optical phenomena of light into a list of its properties, i.e. reflection, refraction, diffraction, dispersion/diffusion and interference. Some of these properties overlap and may be known by different names. My images were reviewed, analysed and selected for the properties of light when shone on and through transparent media, as well as for the properties of water, glass, and plastic. Image making may be informed by the observation of naturally occurring phenomena; I have divided my images into the following categories.
A. Reflection
1. Light Reflection on the surface of water
2. Light Reflection and refraction within water
3. Light Reflection on the surface of glass
4. Light Reflection and refraction on and within glass
5. Light Reflection within glass and water
6. Light Reflection on the surface of glass and water
7. Light Reflection and refraction in plastic

B. Refraction
1. Light Refraction within water
2. Light Refraction on the surface of glass
3. Light Refraction within glass
4. Light Refraction within glass and water
5. Light Refraction on the surface of plastic
6. Light Refraction within plastic

C. Diffraction
Light Diffraction within glass

D. Dispersion
Light Dispersion within water

E. Interference
Light Interference on the surface of water

IMAGES AND DESCRIPTIONS

My research on the properties of light, glass, plastic and water, became the catalyst for my understanding of light. This understanding was used to create photographic images based on the observation of every day, and often unrepeatable, occurrences of light. The physical properties of light, water, glass and plastic show the “dual ability to detach fragments for scrutiny” as Berger (1972: 25) points out that, although “the scientist makes the discoveries, it is the artist who is uniquely qualified to express and communicate them.”

There is much happening in my images, linger, enjoy the detail, it is all in the search and the constant looking, as the images reveal themselves slowly. I have produced visual imagery to show the characteristics of light and have divided them into the following:
A. Reflection

1. Light Reflection on the surface of water

Artificial light reflected off the surface of water at night has a visual appeal to most people.

Neon lights reflected in the flow and mobility of dark night water, on Sydney Harbour, showed the optical phenomena described as moon circles. Streetlights, lights from high-rise buildings and neon lights set off against the dark night of the background, when reflected in moving water create as a distorted vision of line. The surface of moving water, even in its agitated state, (inferior reflection) showed bright reflected colour. When closely cropped the image source was sometimes difficult to identify as it became disassociated with its surroundings. By decontextualising the subject the intensity of colour, pattern, and movement was further contrasted, thereby increasing the sense of abstraction. The dancing light reflections now seemed to look like coloured calligraphy brushstrokes or silk threads embroidered onto woven textiles.

The reflection of the moon (moon circles), in lake water, metamorphosed into a shimmering panel of silvery white, rounded brush strokes, quivering lines richly invigorated the black surface.

The movement of water, a naturally occurring phenomenon, was used as a technique to abstract a reflected subject. Gently moving water, at Port Fairy, reflected a picket fence. The negative and positive shapes were enlivened by slashes of white picking up the brightness between the dark curving lines. These strong curvy lines, meandered across the water surface, reorganised the structures and relationships, now optically appeared to resemble a moving zebra.
A building became distorted and **ambiguous** when reflected in gently moving water of a swimming pool.

Images reflected in the depth of a ceramic pot show a reflection of the sky and plants, as well as leaf matter in the bottom of the pot. These layers of reflection and **transparent** depth create ambiguity and abstraction.

An **achromatic** image of overhead tree foliage, reflected in a water drop, is hard to decipher as the high **magnification** and tight cropping of the **composition** when put together create abstraction.
2. Light **Reflection** and **Refraction** within water

Abstraction appeared in the odd black cross-like shape formed naturally by a raindrop on a black tabletop. Tight cropping and a close-up view emphasised the shape.

Green layers on and within the water, distorted the reflection of a fishing boat on the surface of the water and yet it seemed to be merged within the seaweed growing on the sea floor.
Below are a variety of images showing inferior reflection on the surface of water and its states, i.e. frozen, liquid and gas. The restless textured surface of water caused by waves, condensation and raindrops contrast with the calm surface of an undisturbed body of rainwater on the surface of an outdoor tabletop, and a sheet of ice formed on the surface of a pool. The dull and overcast light formed a diffused inferior reflection, and in some cases the disturbed water surface. Abstraction was created by compositional cropping and in some cases magnification, to destroy the context of the setting.
3. Light **Reflection** on the surface of glass

A small group of architectural views of glass buildings show **superior reflection** in the windows of multi-storey buildings. The windows acted as a mirror and made the image more complex, creating distortion and abstraction. The photographs capture reflected images composed of a multitude of window frames that formed repetitive geometries within the surrounding environment. The rectangular windows produced pictorial tensions by a series of criss-crossing, interdispersed and overlaid horizontals, verticals and diagonals. The glass windows act as a mirrored eye that manipulated surface forms and colours.

Simplification of the subject reflected in the windows became repetitive **motifs** of abstraction and distorted multiplication. **Repetition** was used to create visual movement and this is a compositional method used as a means to draw attention. The mirror is an extremely complex symbol of how the world is viewed, the mirror here is a device that established where the viewer was, but was also a reflection of something seen by the viewer.
4. Light **Reflection** and **refraction** on and within glass

This series relied on using glass as an **optical** instrument to create distortion and thereby abstraction. The following images show how everyday items also can become abstracted when viewed from a different angle.

The **angle of view** was tilted downward, looking into drinking glasses. The thick base of the glass acted as a **concave** lens and formed an upside down reflected image. Repetitive circular lines that outlined tonal coloured shapes surrounded the central base of the glass. This expanded circle of mirrored reflection draws attention to the silhouetted shape in the central circle, circular lines **radiating** outwards, cyclical and **rhythmic**, echoing the central shape. The glass did not contain liquid and it was located on a stainless steel surface close to a windowsill. The colour blue was a reflected tone from the stainless steel surface. The items on the nearby windowsill were **silhouetted** against the morning southern light, and due to close cropping of the image; the viewer must try to decipher the object.

A closely cropped photograph of a glass containing red wine, when viewed from a high vantage point looking down into the glass, appeared disassociated from its reality. Abstraction and amazing refractions were observed when a green glass, with moulded rings, was placed on a ribbed stainless steel draining board. The moulded rings of the green glass optically distorted the ribbed lines in the stainless steel.
Abstract views were achieved when light was reflected and refracted on and through textured glass; some were backlit, while others were viewed with frontal light.
5. Light **Reflection and refraction** on glass and water

My series of glass, water and light reflections share an abstract capacity as they show commonplace household articles, such as jelly moulds, metamorphosed into fractured facets zigzagging reflection and refraction of light. By using coloured vegetable dyes in water I was able to introduce colour into the glass jelly **moulds**, as well as reflecting the objects when placed on glass mirrors. This has created visual confusion for the viewer. The decorative cut glass patterns when hit by light produce a facetted, fractured surface of glowing coloured shapes.

A series of glass domestic accessories were transformed into glinting mirroring surfaces by the addition of colour, light and water. Under bright sunlight conditions, mirrors were used to manipulate light reflections and refractions. Glass jelly moulds containing coloured water were placed onto a **mirror** to intensify the light. A mirror was used to control the placing of the light to **emphasise** the rounded **shapes, patterns** on the glass surface, and the rich and vibrant colour patterns formed. I examined the composition through the camera lens and made many re-arrangements. The colours were predominantly red, yellow and blue tones and the colours created a spatial flow through and around the image, enlivened by slashes of colour that picked up the brightness of the shapes formed.

On some of the jelly moulds I introduced another method of abstraction by using coloured **leadlight** windows to shine onto the coloured water within the jelly moulds, this **overlay** of coloured light has broken and fractured the previous shapes into unexpected colours. The three primary colours of light, red, green and blue, have become the means of colour change by overlaying one **transparent** colour over another. Surface form and colour were deconstructed and reorganized by the transparent additive layers of coloured light. A simple coloured leadlight window cast coloured light and shadows onto glass jelly moulds filled with coloured water. Coloured light appeared to lean in a similar direction and cast its parallel shadow. What appealed to me was the **translucent**, transparent tones of colour and light from behind, which seemed to form a thin film of colour with an inner glow, the atmosphere seemed full of colour waves.
6. Light **Reflection** on the surface of glass and water

Light and is reflected off and into mirrored glass, this created abstraction as it appeared to be composed of many layers each layer reflecting another layer, creating visual confusion.
7. Light **Reflection** and **refraction** in plastic

The properties of plastic are based on its capacity to convey transparency and **opacity**. As well it has chemical properties such as **solubility**, resistance, **thermal stability**, **permeability** and environmental **stress fracturing**. While the mechanical aspects relate to specific gravity, the **refractive index** and **impact resistance**. I have used the plastic properties of refraction, transparency and opacity.

Images have been abstracted by close cropping to decontextualise the object, as does the compositional techniques of pattern, repetition of line and shape.
B. Refraction

1. Light Refraction within water

Light when it passes through different transparent mediums such as water is refracted. The movement of water refracted light into line as the edge of a wave is thicker and it was this edge, when light refracted through it, which formed line. Examples show shallow sea water ripples flowing over sand and variegated coloured rocks.

Swimming pools show light refracted through a gentle swell rather than a fast moving ripple. The line work appeared wider apart and circular. Compositional techniques show close cropping and an aerial viewpoint.

![Images of water refraction examples](image1.jpg)

![Images of water refraction examples](image2.jpg)

![Images of water refraction examples](image3.jpg)
Water droplets are curved due to the **cohesive** and **adhesive** properties of water. Light refracts through a water drop and can act as a **prism**. A water drop can also act as a **convex** lens and show the surrounding environment transformed into an upside down view.

My eye was attracted to the unusual light falling on the surface of water drops upon a black table. One drop appeared to be in the form of a cross and the almost **monochrome** overall coloured light made the cross shape appear as gleaming metal. A cold white light seemed to emanate from the shape and instilled an otherworldly quality, a **spectral** presence. The cohesive surface tension of the water drop manipulated the surface form.

When viewed from underneath a sheet of glass, water drops formed **inverted** shapes looking like rock or liquid mud.

Compositional techniques used were close cropping, colour, contrast, line, irregular shape and radiating circular shapes.
Bubbles are composed of air covered with a thin layer of water and occur on the surface of water and also within the body of water. Bubbles on the surface of water reflect light and in certain circumstances may also create interference. Reflections manipulate the multiplication of surface forms and colours, and dominated the image. Visual movement occurred due to the repetition of form. A blue palette was appropriate as the photograph was taken in the light of a cold UK winter.
Frost is a solid property of water and occurs when the outdoor temperature falls below freezing point. This results in the deposit of ice crystals. Crystals of frozen water are deposited onto cold surfaces and, contain molecules that are arranged in geometrically repeated patterns. Magnification and cropping captured monochrome images that appeared unreal and ambiguous, existing in a world of their own. Magnified images of frost crystals created sparkling abstract lines and shapes, appearing as unusual organic tufts or growths.
Photographs of the moving human form submerged and partially submerged in a water environment turn the figure into coloured shapes. The figure in water series is not about calm and peace, the figure surges within the water and when caught by the camera, appeared to be facetted into a million refractions and reflections. My work transformed and abstracted the image by splitting the experience of viewing into many fragments. The water movement made the figure appear to be constructed, deconstructed and reconstructed as parts link yet the figure appeared to exist in both a “time-bound and a timeless continuum.” (Burnett: 1995: 67)
Another method was to show the figure behind a wall of water. The movement of water flowing down a glass window created different deformed shapes and this helped to capture a distorted abstract vision of the figure.
2. Light **Refraction** on the surface of glass

A French glass door with patterned glass was softly silhouetted in black wrought iron. The glass pattern, when viewed from a distance, created a frosted feel, but when seen up close, minute detail created small sparkling facetted glimpses of light.

Shattered **safety glass** created lines radiating from the central point of impact formed a shape called a **star break**. Refracted light appeared along the edge of each glass crack. This image was taken at mid-day on a sunny autumnal day, in a sheltered area at a shopping centre, with no direct sunlight. Tonal, low contrast **refraction**, due to subdued lighting conditions, is displayed in this image.

Another pane of shattered glass displayed an irregular pattern. This photograph has a low **depth of field**, due to cold winter light and poor lighting conditions at a railway station. A bluish white light emanates from the edges of the shattered cracks in ways that reorganise the structures and relationships of the shapes.

A magnified close up view of moulded glass showed a diamond-patterned surface with diagonal bands that were repeated in transparent layers.
3. Light **Refraction** within glass

Curved glass, blown glass, slumped glass or crystal and cut glass used in vases and bowls plus the water in these glass containers help to break up the face into scintillant specks of light and colour. Glass bricks have unique properties that encourage distorted views, many include bubbles within the glass, some have irregular patterns and some have been produced with rigid regular patterns. One of the photographs show moulded glass almost appearing as a spiral, turning centrifugally through its space. As an abstraction technique glass created many different variations, as it was dependent on the thickness, the convex or concavity and the imperfections within the glass. Close cropping, magnification and the angle of view created abstraction and non-legibility.
5. Light **Refraction** within glass and water

Bubbles are a thin transparent layer of water held together due to its cohesive properties and show surface repetition of smooth shiny rounded forms. Bubbles within the glass vase as well as the bubbles within the water, helped to distort the straight lines of the immersed flower stems. While the round water drops viewed through a thick layer of glass become decorative balls of refracted line and colour. Refraction created geometries of the natural environment to produce pictorial tensions and transparent coloured layers. Close cropping and varied viewing angles create ambiguous images.
7. Light **Refraction** on the surface of plastic

Visual movement was created by light glinting on parts of the intricate structure of headlights and taillights, when reflecting the myriad parts. Rectangular checked patterns and the grided multiplication of the image emphasised a feeling of delicacy and strength. The repetition and simplification of the plastic surface created a duplication of motifs and produced pictorial tensions. Repetition was a means to draw attention, but the eye loses itself quickly in the infinite repetition of patterns and positive and negative spaces. The grid imposed a sense of order and structure on the image, yet at the same time, distances the viewer, as the image source is sometimes difficult to identify. Close cropping intensified the horizontals, verticals and diagonals and helped to abstract the images.
6. Light **Refraction** within plastic

The following photographs show artificial light within plastic traffic lights, Christmas lights, neon lights and environmental signage, when viewed at night. The signs are predominantly pure saturated colours, strongly contrasting with the darkness of night. The absence of the visible suffuses a ghostlike atmosphere; the colours and the intense contrast of the light itself reinforce this, as the rest of the space is overwhelmingly black. The plastic covering of the light acts as filter to manipulate surface forms and colours. This became a way of reorganising the structures and relationships within the blackness of the background. Exploitation of simple contrast achieved dramatic and arresting images, while close cropping of the image forced the viewer to engage in the creation of self-referencing.
C. Diffraction

Light Diffraction within water and glass

Diffraction of light through a wine glass creates a shape almost like a crystal drop hanging from a chandelier. Magnification of the modest drop shows transparent layers of light gleaming on the surface edge like a many faceted crystal.

Light bouncing off the bevelled edge of a mirror produces the prismatic colours of the rainbow.
D. Dispersion (scatter)

Light within water

Permeated by a sort of eerie half-light, barely visible objects are shrouded in a foggy veil that makes them mere shadows. The absence of the visible suffuses a ghostlike atmosphere that was reinforced by the mist of fog that de-saturated the colours and blurred the object like a soft focussed film image. Water droplets within the fog created light dispersion.

E. Interference

Light on the surface of water

Bubbles are a thin transparent layer of water held together due to its cohesive properties and surface tension. Pale smooth shiny rounded forms were dominated by the repetition of the rainbow-like colours of interference. Dishwashing liquid and a waterfall of moving water splashing into a pool forms bubbles transformed by prismatic coloured shapes.
MY PROJECT OUTCOMES
My Project Outcomes

The aim of this study was to investigate and use the physical properties of light to capture some of its diverse effects when shone onto and within various transparent mediums. This process has enhanced my understanding of light. My design experiments, informed by my reading and personal experience, demonstrate that I have attained a level of control in dealing with the many different and often elusive ways in which light plays a role in my creative process. My research also introduced me to the restrictions and flexibility of digital photography and helped to develop my skill as a photographer.

This study has helped me to become more consciously aware of my intuitive creative processes. I struggled to describe my images verbally and in writing, and to adapt to the requirements of an academic project. It was difficult to document the thoughts and reasons behind a decision which related to my own work. I had the ability to discuss my graphic design work and the design work of others, but lacked confidence to analyse and discuss the reasoning behind my concept. Most decisions are contained in the mind and the reasoning behind the decision becomes intuitive. This study has been an opportunity to shake myself out of my comfort zone and to question my image making, as many of my decisions had become intuitive and thus un-examined. When looking at an object in different light conditions I trust my intuition, which has become automatic and has been developed over many years of looking at and seeing the wonder of natural occurrences. This study has made me realise how much I rely on my intuition. For example, I was unaware that my images were all tightly cropped until it was pointed out to me. Through this study I feel I have gained more understanding of my own creative processes and am more confident to articulate and justify my images in a logical way. My previous assumption was that my fixation with observation and perception within my images was just fundamental. The process of research has exposed me to a new way of thinking, relying on facts rather than intuition. I feel better able to understand and communicate my own concepts. For example, categorising my images in terms of the optical phenomena of light and the use of a glossary has made it possible to create precise descriptions that can be used to explicitly explain concepts that might otherwise be left unexamined.

Describing the images in this study has helped me to learn more about my areas of interest - observation and visual literacy. Descriptive language was used to discuss each category and determine what the photographs demonstrated. Through discussing light and its effects, my skill in the use of visual language has increased. In particular, my glossary helped me to describe what I see in my images rather than just looking at them. This vocabulary will continue to guide me in remaining an observant designer, and assist me to illustrate the value of observation in design education.

From my experiment of attempting to get my design students to see in the same way I did, I learned that while light gives us a shared space/time continuum, the way in which it is perceived is very personal. Sharing one’s understanding of light is not easy, and illustrating its properties tells me more about my own character and personality than anything else. My photographs are to document and inform, but they are also my form of verbal communication and narrative, as well as a way of presenting phenomena which I
feel should be valued. The impact of my images presented as part of this exegesis cannot be measured without further exposure to a wider audience. However through research, analysis of design history, and the design process itself, I have demonstrated that image-making can be engaged in presenting possibilities for better observation.

Researching my creativity has helped me to gain more knowledge about my teaching practice. Loughran (1999) explained, "As teachers we should shake ourselves out of our comfort zone and begin to question our learning about teaching, not only content but also how we teach." My teaching practice has benefited from my study as it has encouraged me to ask more questions, to analyse, and to take on new perspectives and alternatives. In addition this project has provided me with a wealth of experience on which to draw as a design teacher. The role of design incorporates an act of thinking and doing by building on a context-informed practice. (Schon:1988) By self-reflecting on my images I have engaged in the relationship between the designer, the project and the audience.

By embarking on this rich self-study I feel that I have moved beyond my personal experiences and have learned more about light and its importance in image-making. I have extended my visual language, which I plan to use in conjunction with my images to help develop visual literacy in my design students. My observation skills have increased, as I am always alert to the possibility of capturing the fleeting effects of light. In the future I would like to do further experimentation into light and its properties in order to develop new series of images. I would like to explore in more detail artificial light such as, traffic signs, neon signs, digital lights and tungsten lights. I hope to take on a new perspective and move beyond my current image making. Rather than convey a narrative or a social message, my aim is to try to awaken a sense of surprise and wonder through using my way of looking at the phenomenon of light.

"The more we involve ourselves the greater the enjoyment through the perception of seeing. Seeing is the beginning - a gift for some, developed in others, but always rare." (Walker: 1988:7)

Not only do I now see what I do in a different light, but also I can observe how others see the same light differently. My language of observation and capacity to communicate what I see, capture and edit photographically, has enhanced my creative practice and my teaching. My research demonstrates this process.
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APPENDIX:

Glossary

**Abstract:** Not aiming to depict an object, composed with the focus on internal structure and form

**Achromatic:** A colour lacking hue, therefore black white or grey

**Adhesion:** A property of water, the ability to stick to a surface

**Artificial light:** Man-made light, not from the sun or other natural light sources such as naturally occurring fluorescence and phosphorescence substances and chemicals

**Ambiguous:** Causing confusion due to more than one meaning.

**Angle of view:** The area of a scene that is seen through camera a lens and is determined by the focal length of the lens.

**Balance:** Placement of colors, light, tone and objects in a picture to create harmony.

**Beveled Glass:** Clear plate glass with ground edges polished at a specific angle. The angled edges or bevels, cause light to be prismaticall refracted, often creating rainbow-like colours.

**Bull's Eye:** Impact damage to laminated glass that is marked by a clean, separated cone in the outer layer of the glass.

**Calligraphy:** Art of handwriting.

**Camera Angles:** Various positions of the camera (high, low, left, right, etc.), each giving a different viewpoint or perspective of the subject.
**Capillary action:** The ability of water to rise or fall when in contact with a solid medium.

**Close-up:** An enlargement of an area.

**Cloud:** A cloud forms in the atmosphere as a result of condensation of water vapor.

**Cohesive:** Stick together to form a whole

**Color:** Wavelengths of light perceived by the eye.

**Composition:** Arrangement of the elements within a scene, showing the main subject, the foreground and background, and supporting subjects.

**Concave:** A concave glass lens has at least one side that bends inward, always making objects look smaller.

**Condensation:** The process of water vapor in the air changing into liquid water, for example, when hot steam meets cold glass, water drops form.

**Contrast:** An obvious difference when compared to something else, in photography it could be a difference between a darker or lighter tone or colour.

**Convex:** A convex glass lens has at least one side that bulges outward, making objects look larger.

**Cropping:** Showing only part of an image, usually for a more pleasing composition. May also refer to the framing of a scene in the camera viewfinder.

**Decontextualise:** Remove part of the environment within which something exists.

**Depth of field:** The amount of distance between the nearest and farthest objects that appear in sharp focus in a photograph. This depends upon the aperture, the focal length and distance.

**Diffraction:** When light waves are obstructed, waves bend or spread around an object, such as cloud or water droplets, producing fringes of coloured bands.

**Diffused lighting:** Lighting that is low or moderate in contrast, such as on an overcast day.

**Dispersion:** A ray of light refracts when shone through a prism, so that it spreads out or disperses the colours as a continuous spectrum. Dispersion is a property of all transparent materials such as air, water, glass and clear plastic, but the variation of refraction is small and only visible in certain situations.
**Distortion:** Altering something out of its normal shape by stretching, bending, twisting so that it becomes unclear or unrecognisable in such a way that people are deceived.

**Emphasis:** Highlight the importance of something by size, contrast, shape, colour, tone or texture.

**Facet:** Faces or segments of cut surface such as crystals, gemstones or glass

**Fog:** When warm moist air moves over a colder surface, cooling that air to below its dew point, a mist or thick fog develops.

**Grid:** Vertical and horizontal lines interlocking to form a network

**Ice Crystals:** Shapes formed when water freezes, may be needles, stars, columns and plates.

**Illuminate:** Use of light to make something visible.

**Impact resistance:** Ability to oppose the force of something hitting another object

**Inferior Reflections:** Showing light reflected off a textured, dull, disturbed or moving surface.

**Interference:** Occurs when light is diffracted or refracted to form a spectrum, for example, colour in soap bubbles, oil spills and mother of pearl.

**Invert:** Reverse the position of something.

**Laminated Glass:** Safety glass that has a layer of plastic bonded between layers of glass and used mainly for windscreens.

**Leadlight:** Strips of lead fasten pieces of coloured glass together, used to make leadlight windows usually seen in churches.

**Lens:** Glass optical system used to concentrate and focus rays of light in a desired direction.

**Luminous:** Visual quantity or surface brightness of objects that emit or reflect light.

**Magnify:** Lenses and mirrors often magnify objects to appear larger.

**Mirror:** A reflective surface made by a deposited layer of silver on one surface of glass.

**Moon circles:** Rapidly moving points of moonlight on water create closed circular loops

**Monochrome:** One colour and its tones and tints.
Motif: A shape that repeats itself to form a pattern.

Mould: Shape or form.

Movement: The act of changing position, location or direction.

Neon: A gas, contained within glass tubing that glows when electricity is passed through it.

Opaque: Material that is impervious to light and does not transmit light.

Optical: Relating to lenses, vision and light.

Overlay: Superimpose a layer on top of something

Overcast: Dull light caused by cloud covering sky and sunlight.

Pattern: Repeated motif or decorative design.

Permeability: The rate that a liquid or gas passes through a substance.

Precipitation: All forms of water, liquid or solid, that falls from clouds and reaches the ground. This includes drizzle, hail, ice crystals, rain, snow, sleet, dew and frost.

Prism: A cut glass solid geometrical shape used for dispersing a beam of light into its spectrum.

Prismatic colours: Creation of colour when white light is refracted when shone through a prism.

Properties of water: Adhesion and cohesion, surface tension and capillary action. Water has three states - frozen, liquid and gas.

Radiate: Spread out from a central point.

Rain: Water drops, formed by precipitation, falling to the ground.

Rainbow: A spectrum of sunlight is formed by refraction, reflection and the dispersion of light by water droplets.

Repetition: Act of repeating something.

Reflection: The returning or bouncing of a light wave off a surface. Reflections can be either superior or inferior, depending on the surface.
Refraction: A change in direction or bending of light as it passes from one transparent medium into another, causing the optical illusion of displacement of objects. The medium, such as air, water or glass, have different densities and this affects the speed of light moving through it which creates the refractive index.

Refractive index: Mathematical equation used to describe the effect of a lens in causing light rays to bend (Snell’s Law).

Rhythmic: Regular repeating pattern.

Rippled Glass: Rolled sheet of glass with textured ridges appearing, on one side, as rippled wave patterns.

Safety Glass: Laminated or tempered glass.

Saturation: The amount of hue in a color. Saturated colors are vivid or strong. Desaturated colors are often dull or weak.

Shape: Outline of a solid form.

Side-lighting: Light striking the subject from the side producing shadows and highlights.

Silhouette: Solid black shape formed by backlighting a subject or object.

Soluble: Able to be dissolved in liquid.

Soft Lighting: Lighting that is low in contrast, such as on an overcast day.

Spectral: Relating to the colour spectrum.

Spectrum: White light when refracted through a prism separates into different colours. A rainbow is naturally occurring spectrum.

Star break: Various-sized cracks in glass radiating from the central impact point, often seen in the damaged windscreen of a car.

Stone Break: A break on the outer layer of a laminated windshield, such as star breaks, bullseyes or combination breaks.

Stress fracturing: Any crack extending from an edge without an impact point.

Suffuse: To spread in different directions, over or through a medium.

Surface tension: A property of water. The surface of water has a tension that allows it to form into separate drops.

Superior Reflection: Showing clear and intense mirror-like reflection.
**Texture**: Feel of something, smooth, slippery, rough, etc.

**Thermal stability**: Materials ability to stay the same after reacting to heat and coldness.

**Tonal**: Relating to various shade of a colour.

**Tone**: The lightness or darkness of colour; also referred to as value. Cold tones (bluish) and warm tones (reddish) refer to the colour of the image.

**Translucent**: A glowing appearance. Material may transmit light diffusely, objects may appear vague or distorted.

**Transparent**: Material transmits light clearly. Allowing light to clearly shine through a material or film.

**Water Glass**: Hot glass sheets passed through textured rollers to capture a wavy, blurry look.

**Wave**: A repeating series of ripples that move through or over the surface of a medium, such as water, sound, light, usually with a periodic speed depending on the properties of the medium.