Figure 1.1
Pablo Picasso. *The Old Guitarist*. The Art Institute of Chicago. From *The Art* (n.d.) Retrieved October 13, 2004 from theartchive.com

THE MAN WITH THE BLUE GUITAR

By Wallace Stevens

The pale intrusions into blue
Are corrupting pallors...ay di mi,

Blue buds of pitchy blooms. Be content --
Expansions, diffusions -- content to be

The unspotted imbecile revery,
The heraldic center of the world

Of blue, blue sleek with a hundred chins,
The amorist Adjective aflame...

CHAPTER ONE: INTRODUCTION AND OVERVIEW

Introduction

Although the colors in most ancient spaces have become too faded for us to see in their full glory, they were amply used. Ancient Greek structures were brightly polychromatic and the interiors of the Mudejar architecture in Spain were explosions of a variety of colors (Pile, 1997). The seemingly upside-down columns used for support by the Minoan and Mycenaean cultures were painted red and blue. Ceilings in Egyptian temples were colored blue to give the impression of looking up at the night sky. Research into ancient architecture along with the study of extant color schemes gives us a view into how important the role of color has been and continues to be in architecture and design.

Color has always been a means of communication and can act as a universal link when language, written or spoken, has reached a barrier. In early Christian times color communicated certain ideas, such as purity or hellfire, to the largely illiterate masses, many of whom did not speak a common tongue. In the present day red is associated with caution or danger, and a red octagon is understood almost universally to mean stop, whether in English speaking Britain or in Spanish speaking Mexico. Each color has a fascinating history of both symbolic usage and the extraordinary measures taken in producing the pigments.

Light, color, texture and form are valuable tools available to the interior designer or architect when creating a space. Therefore, an understanding of the way in which they can be used for maximum effect is necessary. The tools of the trade must be fully understood before they can be utilized with any degree of success.

Instilling a base of knowledge regarding the use of color is a necessary component of Interior Design programs (fider.org). Understanding historical symbolism and usage of color is an important part of wisely choosing a color scheme and in the appropriate application of color. Without this knowledge, a designer may inadvertently communicate something contrary to their intended message. For example, when the designer understands that blue is a color of mourning

in much of the Arab world, it should affect the amount of blue and the location of that color when designing for that particular cultural group.

The history of the color blue is a social history rather than a history of pure technical advancement in pigment production (Pastoureau, 2001). Therefore, research in this area must address the broad history of the color and its development in terms of social implications such as: language, symbolism and historical usage. In addition, blue is such a difficult color to produce and occurs so rarely in nature that humanity's never ending quest to create and control blue invites a study of its physical manifestations including pigment, dye and paint.

Research

The purpose of this research is to discuss and analyze the historical, symbolic and psychological connotations of the color blue in interior design, as well as provide a reference regarding the use of blue during specific time periods. This knowledge will assist interior designers in better understanding the implications surrounding the color blue and to assist them in making educated decisions regarding use of the color. To fulfill this purpose, it is important to understand the history of the color blue, as well as, its role in art, music, superstition, psychology, and other aspects of life. Therefore, topics ranging from the history of blue pigments to linguistic implications of the term blue, as well as, a history of the use of the color in interior design will be covered.

Overview

This thesis will be organized into eight chapters, beginning with an introduction, a chapter discussing research methodology and six additional chapters beginning with a discussion of color vision versus color perception in chapter three. The fourth chapter will cover the various blue pigments, how they are produced and their historical usages. The fifth chapter will contain a discussion of the symbolism imbued in these various blues, what they mean to various cultures and how they have been used to communicate. The sixth chapter will review how English speakers have incorporated the color blue into our everyday language and what that incorporation says about our relationship with the color itself. The seventh chapter covers the psychological affects of the color blue.

The eighth and final chapter will be a discussion of the use of the color blue as relates specifically to interior design and will involve aspects of the various other chapters as design is inextricably intertwined with history and culture. The most commonly used categories in

teaching the history of design, as determined by an overview of major design history texts, will be used to follow the history of the use of the color blue in design. I will begin with a discussion of ancient cultures such as the Egyptians, Greeks and Romans and move through to a view of current trends in design. The use of colors specific to interior design such as: Wedgwood blue, Tiffany blue and Williamsburg blue will be included in the design history. The design periods to which I refer in this section are defined below along with any other technical terms that are used in this thesis.

Definitions

Aesthetic Movement
An English style intended to rebel against the over ornamentation of the Victorian style, includes the Arts & Crafts movement and Glasgow School of Art, late 19th century early 20th.

American Federal
A stylistic continuation of Colonial but post-revolution, 1780 – 1830.

American Georgian
American version of Georgian style, late 18th century.

Ancient Greek
Greek culture between the years of 1000 BCE and the 2nd century BCE

Ancient Roman
Roman culture from the 2nd century BCE until 410 CE.

Art Deco
American style that uses decorative elements to suggest technology, 1920's – 1930's.

Art Nouveau
Continental European style intended to rebel against over ornamentation of the Victorian style, includes Vienna Secessionists, late 19th century early 20th.

Baroque
A stylistic development found in Italy, Austria and S. Germany during the 16th century and Spain and Portugal during the 17th century. It is a dramatic, vibrant style utilized by the Catholic Church in its counter-reformation effort. Reflection of impatience with classical code of Renaissance design.

Blazon
To describe (a coat of arms) in proper terms. To paint or depict (a coat of arms) with accurate detail.

Churrigueresco
Spanish style named for architect Jose Churriguero, rebellion against strictness of Desornamentado, very florid 1650 – 1780.

Colonial	The North American style derived from English design, 1610 – 1776. When not derived from English design the country of origin is specifically noted such as in Dutch Colonial.
Desornamentado	Spanish style created by Juan de Herrera for use at royal palace of El Escorial, bare and stripped down, literally translated: without ornament, 1563 – 1600.
DibromoIndigo	Indigo dye that is bound by rock snails to bromine extracted from the sea. In liquid form it is blue but becomes purple when used as a dye in pure form.
Early Christian/ Byzantine	The Eastern half of the split Roman Empire beginning around 330 CE when Constantine declared Christianity the state religion.
Egyptian:	The pre-Greek civilization thought to have the most possible influence on Western civilization.
Elizabethan	English style from 1558 – 1603.
elutriate	To wash or strain out so as to purify; as, to elutriate the blood as it passes through the lungs; to strain off or decant, as a powder which is separated from heavier particles by being drawn off with water; to cleanse, as by washing.
Empire Style	Style concurrent with Napoleon's empire, 1804 – 1814. Reflective of his military experience.
Georgian	English style which is often divided into three substyles: Early Georgian or Decorative Queen Anne, 1714 – 1750; Middle Georgian, most commonly known as Chippendale, 1750 – 1770; and Late Georgian, 1770 – 1810. This covers the reigns of King George I through King George IV.
Gothic	European style ranging from the 12th to the 15th century CE.
Jacobean	English style named for James I of England, includes the reign of Charles I, 1603 – 1649.
Minoan & Mycenaean	Cultures which occupied small Aegean Sea islands, Crete and mainland Greece from 2200 BCE until approximately 1000 BCE when they were displaced by Dorian invaders from the north.
Modernism/ International Style	An international style which is characterized by limited color use, acceptance of the machine aesthetic and use of new materials, 1920's – 1960's.

Mudejar	Spanish style resultant from the mix of Islamic and native styles 8th century to 17th century.
Neoclassicism	French style under Louis XVI 1765 – 1790.
Plataresco	Spanish style of the first half of the 16th century.
Post Modernism	Style which rebels against modernist seriousness and embraces American kitsch, 1960's – present.
Queen Anne	English equivalent of late Baroque style, 1702 – 1714
refractive index	The factor by which electromagnetic radiation of a frequency is slowed down (relative to vacuum) when it travels inside the material.
Regence	Decorative French style during the transition between Louis XIV and Louis XV 1715 – 1723
Regency	English style from 1811 – 1820.
Renaissance	Began in Italy in the 14th century, the beginning of modernization of the Western world. This style is dominated by a revival of classical design.
Restoration	Style named for the restoration of the monarchy after Oliver Cromwell's death. It is often subdivided into two categories: Carolean 1660 – 1689 and William & Mary 1689 – 1702.
Rococo	Softer offshoot of the Baroque style found in interiors in France, Austria and S. Germany during the 18th century, coincides with the reign of Louis XV (1730 – 1765).
Romanesque	The Western half of the split Roman Empire which would dominate design in Western Europe beginning with the Carolingian Period following the dark ages from 750 CE to 1100 CE.
Suda	A massive 10th century Byzantine Greek historical encyclopedia of the ancient Mediterranean world, derived from the scholia to critical editions of canonical works and from compilations by yet earlier authors.
Sumptuary Laws	These laws enacted in various countries to attempt to restrict the sumptuousness of dress in order to curb extravagance, protect fortunes, and make clear the necessary and appropriate distinctions between levels of society.

Tudor	English Renaissance style of architecture concurrent with Tudor monarchs, 1485 – 1558
Victorian	English style coinciding with the reign of Queen Victoria 1837 – 1901. Characterized by a profusion of ornament and a mixture of styles. Eclecticism and revivalism are parts of this stylistic movement.
Distemper	A preparation of opqque or body colors, in which the pigments are tempered or diluted with weak glue or size instead of oil, usually for scene painting, or for walls and ceilings of rooms.
Philosopher's Stone	A substance that was believed to have the power of transmuting base metals into gold.

CHAPTER TWO: RESEARCH METHODOLOGY

To best understand the history of the color blue, historical research techniques were used. Historical research involves the "systematic collection and evaluation of data to describe, explain, and thereby understand actions or events that occurred sometime in the past." (Fraenkel & Wallen, 1991, p. 573). The historical research techniques for this thesis involved defining the problem, locating relevant information, compiling and evaluating the relevant information, and interpreting and presenting the findings and conclusions.

1. Problem definition: There is a gap in the literature concerning the historical, symbolic, and psychological implications pertaining to the use of the color blue in the field of interior design.
2. Location of relevant information: Journals in interior design, art and architecture were reviewed, as well as a variety of texts available relating to symbolism in art, color theory and general histories of color. Texts relating to art history, history of interior design, linguistics, and writings by design theorists were searched for useful information relating to the color blue.
3. Compilation and evaluation of relevant information: The sources mentioned above were searched in order to reveal the most salient points regarding the color. This required keeping detailed notes and note cards and then sorting the information for relevance and importance, as well as, placing the information in the appropriate category for discussion. All information was carefully cited, for easy reference by anyone wishing to do so. Every attempt was made to find primary sources. Terms and definitions are included in Chapter One.
4. Interpretation and presentation of findings related to the color blue in general: The collected information then will be categorized in a logical, readable fashion in order to be most useful to the reader.
5. Interpretation and presentation of findings related to Interior Design: This will consist of a summary of the findings of significance to the field of Interior Design, filling the current gap in literature in that area.

6. Conclusion: This will give a summary and a brief review of the salient information presented within this thesis.

One of the difficulties when conducting historical research, in terms of epistemology, is the temptation to interpret historical resources based on our own modern thought processes (Pastoureau, 2001). The historical information must be contextualized within its own time period and that period's knowledge, social customs and life trends. For example, it would be inappropriate to apply modern color symbolism and perception to the interpretation of the use of blue in an ancient work of art. That would be anachronistic and provides false information, valueless except in the sense of a comparison of the two meanings. Therefore, it is very important to develop a system of interpretation based on the objects and texts themselves and not current logical models.

CHAPTER THREE: VISION & PERCEPTION

Introduction

Color theory is composed of two branches, the science of vision and the study of human perception of color. Vision is a neurological act that involves rods, cones, and the optic nerve, while perception is a social and cultural phenomenon (Pastoureau, 2001). When the color blue enters the human eye it stimulates, in a normally sighted human being, the same chemical and physical reactions throughout written history and across cultures. However, when the human brain perceives the color blue it is filtered through that individual's experience both on a personal level and on a larger social and cultural scale. This difference between human vision and human perception was first noted by Pliny (23 – 79 CE) in his *Natural History* where he states, "It is by the aid of the mind that we see, by the aid of the mind that we enjoy perception; while the eyes, like so many vessels, as it were, receive its visual faculties and transmit them" (Pliny, 39/1855 book 11 ch. 54).

If you showed the color blue to a citizen of ancient Rome, he would believe it to be an ugly color, while to a modern European it would be an attractive, favorable color (Pastoureau, 2001). For example, blue eyes were seen in ancient Rome as an indication of base morals and idiocy. Pliny notes that the Emperor Augustus (27 BCE – 14 CE) had blue eyes and, because of these negative connotations, would become enraged if he felt they were being particularly noted (Pliny, 39/1855). In contrast, many modern cultures view blue eyes as a positive rather than negative feature. However, to all of these people, the blue perceived would trigger the same physiological reaction in their eyes. As Birren stated in *Color Perception in Art,* "Perception tends to dissociate itself from actual physical facts" (1976, p 37). In other words, what people believe they see is not necessarily what is physically in front of them. Their personal perception greatly affects what they "see". Therefore, great care needs to be taken when discussing the physical manifestations of colors in vision versus the psychological perceptions of those colors.

Vision

One of the most commonly asked questions about the color blue is: "Why is the sky blue?" An excellent explanation of this phenomenon appears in the book *Color: A Natural History of the Palette* by Victoria Finlay (2003). Finlay asks us to envision color waves as if they were waves in the ocean. Imagine the large oceanic waves as red light waves and the smallest oceanic waves as blue light waves. If we drop small stones into the ocean the large waves are not disturbed by this minor impediment and continue forcefully to the shore, however, the small waves are scattered by the introduction of the stone impediment. The small waves in the ocean act in the same manner as the blue light waves when they enter our atmosphere, the large red light waves are not disturbed by the small particles of our atmosphere and rush right past us and continue their journey, whereas, the smaller blue waves are scattered and greatly slowed by their impact with the particles in our atmosphere and are therefore available to be seen by our eyes.

This only answers why our eyes perceive the sky as blue, not how our eyes perceive the sky as being blue. During the 6th century BCE, Pythagoras (569 – 475 BCE) put forth a theory on vision, now known as extramission, that described seeing as occurring when the eyes of the viewer actively sought color in the objects at which they looked (Pastoureau, 2001). The eyes performed this action by emitting rays that sought the characteristics of a given object. Epicurus (341-270 BCE) held to the belief that ray emission was a vital part of the process of seeing color but he proposed that the rays came from the objects themselves and not from the viewer, an idea known as intromission.

Plato (427-347 BCE) integrated these two theories when he postulated that color vision was made possible when there was an interaction between the rays emitted by the objects and the rays cast out by the eye searching for the object's characteristics (Pastoureau, 2001). Despite the advances that were made in the understanding of human vision, such as Galen's (130-201 CE) discovery of the optic nerve, Plato's theory was believed to be true until the Renaissance.

It is now the firmly held belief that color, as such, does not exist until it is seen. In the same manner in which a tree falling in a forest makes no noise if no one is there to hear it, light waves are not color until received and processed through the eye and sent to the brain for interpretation.

The Eye

Pliny stated, "The most learned authors say that there are veins which communicate from the eye to the brain, but I am inclined to think that the communication is with the stomach; for it is quite certain that a person never loses the eye without feeling sickness at the stomach" (Pliny, 39/1855, book 11, ch. 55).

The lens of the eye focuses light waves on the retina where there are photoreceptors, which are light sensitive cells, called rods and cones (see fig. 3.1) (Miller, 1997). The rods are responsible for light and dark vision and the cones are responsible for color vision[1].

The human eye can only see colors within a range of 400 to 700 nanometers, which excludes ultra-violet light and x-rays (Miller, 1997). Three different types of cones, each of which is designed to perceive a certain range of wavelengths, interpret the colors within this range. Blue and green receptors are activated by the shorter wavelengths; green receptors by medium wavelengths and red receptors are activated by the longest wavelengths.

The signals which are sent by the cone or rod receptors cells are transmitted to ganglion cells on the retina which process the information by emitting electrical impulses (Miller, 1997). There are two types of ganglion cells: large and small. Large or magnocellular ganglion cells

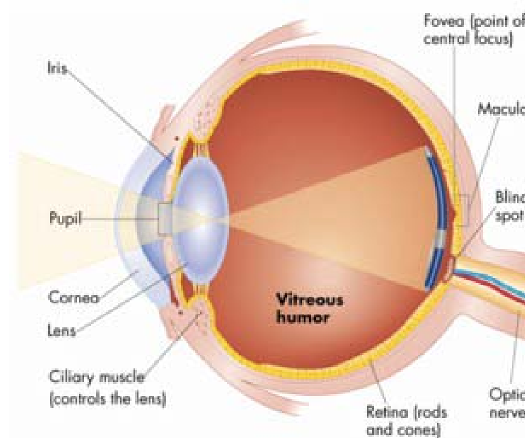

Figure 3.1
Cross Section of the Human Eye. From *Anatomy of an Eye*. Retrieved August, 10, 2004 from tedmontgomery.com/the_eye/

[1] Blue appears smaller and farther away as a color because it focuses at a point in front of the retina causing the lens to flatten and push the blue away (Birren, 1976).

specialize in spatial comparison while small ganglion cells specialize in color. Small or parvocellular ganglion cells differentiate among hues "by comparing and subtracting information provided by the three types of cones" (Miller, 1997 p. 54).

Parvocellular ganglions are themselves divided into two types or opponent cells, red-green ganglions and blue-yellow ganglions (Miller, 1997). If a ganglion is red ON and green OFF it will respond only to red light, if it is blue ON and yellow OFF it will respond to blue light only. The combinations in which these cells are activated allow the human eye to perceive up to nine million colors.

Neural fibers from the ganglions continue through the optic nerve to the neuron clusters or lateral geniculate bodies for more advanced processing (Miller, 1997). From the lateral geniculate bodies information is transported to the rear of the cortex where the information is received in three different groupings: color, form and movement. These three groups are then combined to provide our brains with the complicated visual mixture necessary to create a unified whole.

Color Theory

The idea that there is a set of primary or basic colors is one that has existed for a long time in a great variety of cultures. The Upanishads from the 8th-7th century BCE proposed the first known color theory, which stated the primary colors as red, black and white (Birren, 1965). "Whatever they thought looked red they knew to be the color of fire, whatever they thought looked white, they knew was the color of water, whatever they thought looked black, they knew was the color of the earth. Whatever was altogether unknown they knew was some combination of these three beings" (as cited in Birren, 1965, p.16). The Daoist text, the Dao De Jing (Tao Te Ching, 3rd century BCE) mentioned that black consisted of the five existing colors black, white, red, yellow and blue (Finlay, 2003).

It was not until the time of Aristotle (384-322 BCE) that dark blue was added to the list of existing colors (Birren, 1965). Aristotle, however, was unable to approach any more closely the issue of color mixtures because he believed that mixing of colors was a physical act beneath his status as a scientist (Ball, 2001). He stated that the combinations of colors should be understood from the standpoint of analyzing their reflected rays. Plato subscribed to the same philosophy of understanding colors with the mind rather than with practical experimentation (adhering to the difference in hierarchy of the practical versus applied sciences). They were therefore concluded erroneously that green, for example, could be created by mixing red and white or by mixing

orange and black. Dismissing the need to have any of these statements verified by actual experimentation, Plato stated "he ...who should attempt to verify all this by experiment would forget the difference of the human and divine nature" (as cited in Ball, 2001 p. 66).

This snobbery would delay the understanding of pigment mixtures and primary colors. It would also lengthen the time before blue's importance as a primary color would be recognized. Pliny's *Natural History* listed the three basic colors as red, purple and violet continuing to deny blue's place among the primaries (Pliny 79/1855). By the 10th century, as made known from a color scale drawn in the Byzantine lexography *Suda,* colors were divided into only two categories: dark and light (Birren, 1965). This bi-polar color scale placed red near white and blue near black.

Da Vinci (1452 – 1519) would admit blue to the ranks of the primary or simple colors of which he believed there were six, in the following order of importance: white, yellow, green, blue, red, and black (Birren, 1965). This introduction of blue as a basic color was one of the most important advances in color theory (Gage, 1993). As a result of Da Vinci's beliefs, blue became a part of the four- color palette beginning in the 1600's, which led towards its later recognition as one of the three primary colors.

Da Vinci also experimented with the mixing of colored lights coming just short of discovering the difference between mixed pigment primaries and mixed light primaries (Ball, 2001). He also began to doubt the theorem in Western art that all objects have an inherent color completely divorced from lighting conditions, shadows, reflections, etc.

Descartes (1596 – 1650) theorized that color was created when light was forced through dense particles, which were rotating at different speeds, and therefore, created different colors (Birren, 1965). Red was due to quickly rotating particles and blue to more slowly rotating particles. It was not until Sir Isaac Newton (1642 - 1727) that our current understanding of colors as a variety of wavelengths of light, which combine to form white light, was understood (Gage, 1993). In an act now known as dispersion, Newton used his famous prism to separate white light into colored lights and another to rejoin them into white light again.

Newton was also the father of the familiar color circle (Birren, 1965). He insisted that there were seven colors in light in order to comply with his alchemical notion of the mysticism of the number seven. Therefore, he defined the colors composing white light as red, orange, yellow, green, blue, Indigo and violet and somewhat capriciously related each color to a note on the diatonic scale of music. Blue was related to the note G. Newton was not the only one who

attempted to link the number of colors in white light to a higher system of ordering (Finlay, 2003). It is interesting to note that in other cultures where the numbers of seasons, planets or notes on a scale are different than European numbers, the number of colors believed to compose the rainbow are reflective of that difference. For example, in China five represented the number of notes on the musical scale and five colors were believed to compose white light.

Newton's greatest critic and self-proclaimed expert in color theory Johann Wolfgang von Goethe (1749 – 1832) stated in his book *Die Faber*, "Next to the light, a color appears which is called yellow; and another appears close to the darkness, which we name blue" (as cited in Birren, 1965, p.23). This harks back to the theory in the Suda dividing color into light and dark poles and placing blue near dark.

Goethe further defined yellow as a plus color and blue as a minus color. He also denied Newton's discovery that white light was created by combining all the colors of light as he was unable to create the same result with pigments, not realizing that he was working with two different primary sets (Ball, 2001). Goethe also believed that combining blue and yellow created red, as the blue would draw yellow away from the light end of the spectrum, creating the next darkest pigment, red. He too was impaired by his disinterest in the practical experimentation necessary to verify his reasoning.

Goethe described blue as having "a peculiar and most indescribable effect on the eye. As a hue it is powerful, but it is on the negative side, and in its highest purity, as it were, a stimulating negation. Its appearance, then, is a kind of contradiction between excitement and repose" (as cited in Birren, 1965 p 81). He attempted to create an entire system of dualities based on his color poles associating blue with "cold" and "male," while yellow represented "warm" and "female" (Ball, 2001). This interest in the opposite nature of some colors did serve some purpose in leading others to the idea of contrasting colors. Despite his erroneous assumptions, Goethe was ahead of his time in championing color as a personal experience, demonstrating his understanding of the difference between color vision and color perception.

The polarity of colors was a theme that was taken up by Eugene Chevreul who as director of the Gobelins dyeworks in Paris was asked in 1824 to discover the reasons behind the dullness of the textiles produced there (Ball, 2001). He realized that it was not the manufacture of the dyed products that was the problem but rather the fact that they were worn combined with complementary colors that caused them, when viewed from a distance to mix in the retina as a variety of grey. However, when viewed from less than that distance each color's chroma was

found to be greatly strengthened. This had been innately understood by artists for a long time, however, it was given authority with Chevreul's scientific rather than instinctual explanation. In 1839 he published *On the Law of Simultaneous Contrast of Colors,* which would become an essential handbook for all artists.

It was not until the 18th century that the primary pigments were believed to be composed of red, yellow and blue (Birren, 1965). J.C. LeBlon set forth this new theory in *The Harmony of Color in Painting,* published in 1731. However, this did not put an end to all controversy, and through the 19th century a dichotomy existed between those believing pigment primaries to be LeBlon's red, yellow and blue and those believing them to be red, yellow and blue-violet.

Sir David Brewster (1781 – 1868) in *A Treatise on Optics* advocated what would become known as the Brewstarian Theory when he stated, "The solar spectrum consists of three spectra of equal length, viz. a red spectrum, a yellow spectrum, and a blue spectrum" (as cited in Birren, 1965, p. 29). These wavelengths are actually quite different, red being longer than blue and the difference between these wavelengths not being neatly divided but rather existing as points on a sliding scale. Despite the fact that he was incorrect, he was passionately defended during his time.

It was not until later that it was realized that there are three sets of primary colors, one each for pigments, light, and human vision (Birren, 1965). The pigment primaries are red, yellow and blue, light primaries are red, green and blue and the primaries for human vision, which can also be referred to as "psychological primaries", are red, yellow, green and blue each of which produces a separate visual experience[2]. When pigment primaries are combined, the result is black; when light primaries are combined, the result is white; when the four primaries of human vision are combined, for example, on a spinning wheel, the result is grey.

[2] While yellow is actually a mixture of red and green light, that knowledge is contrary to human intuition, which experiences yellow as its own unique color experience. Each of the psychological primaries is a color which is perceived physiologically as unique and not the result of a combination. This theory was developed in 1878 by Ewald Herring (colorsystem.com

CHAPTER FOUR: PIGMENT

Tracing the development of specific blues is made more difficult by the variety of names that they have been given. The most commonly recognized English language names will be used for pigments in this study. Where a discrepancy is found in various English language sources the name in the *Colour Index* will be given preference. The name of each blue changes when it is translated into another language or produced by a different company. For example, Prussian blue has alternately been known as Iron blue, Milori blue, Antwerp blue, Berlin blue, Chinese blue, Erlangen blue, gas blue, Hamburg blue, mineral blue, new blue, oil blue, Paris blue, paste blue and steel blue among others (Fitzhugh, 1997).

The lengths that humanity has gone through to produce the color blue are astounding and the variety of blues amazing when considering how rarely the color occurs in nature[3]. However, it seems that in whatever form it can be found, humans desire to utilize it. For example, Biblical blue, a pigment used in the ancient Mediterranean, was produced only when a liquid found in the glands of hermaphroditic snails called Murex was exposed to light and air causing it to turn blue. This pigment is only possible to create, however, when the snail is more male than female[4] (Achenbach, 2003). A Japanese ink painting technique called *suiboko* is executed with a blue pigment that is created from fishbone extract combined with glue (Theroux, 1990). This combination is compressed into a block and when mixed with water produces a lovely blue.

For much of painting history, blue could only be created using ground lapis lazuli, a stone which had to travel from Afghanistan to Europe for sale and, as a result, was very expensive. Therefore, having a painting with a large amount of blue in it was a symbol of wealth and high status.

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[3] Humans are not the only creatures that are enchanted by the color blue. Magpies are enthralled by the color and male magpies will collect as many blue objects as they can find and array them in front of their nest in an attempt to attract female magpies.

[4] Add to this the difficulty that according to the Talmud, these snails are only available to produce the pigment once every 70 years and the great value placed on the color because of its rarity comes into clearer focus (Jacobs, 1958).

The discovery of blue pigments has almost always been of an accidental nature and many times their discovery or invention was a byproduct of an attempt to create something entirely unrelated (Ball, 2001). Alchemy led to the discovery of a variety of pigments, a connection which is noted by Cennino Cennini in his guide to pigments published circa 1390. Many were discovered by alchemists trying to get their materials to go through the appropriate color changes necessary to create the philosopher's stone.

During the 17th and 18th centuries there was little innovation in the science of pigment because brown and natural tones were preferable. Sir George Beaumont is often quoted as saying, "A good picture, like a good fiddle, should be brown (as cited in Ball, 2001.)" However, this brief setback could not hinder humanity's search for better blues.

Later the development of pigments would fall to the newly fashionable science of chemistry (Ball, 2001). The discovery that coal tar could be manipulated so as to create mauve[5], a pigment for which there was great desire during the 19th century led chemists to search for other colors that might be made from the gas lamp waste product. This led to the discovery in 1860 by Charles Girard and George de Laire that an alteration of the process for creating magenta[6] could create analine blue.

Most recently, Biotech blue was discovered in Australia by Elizabeth Gillam a biologist who was studying a culture of bacteria injected with human DNA, which to her great surprise, turned blue (Achenbach, 2003). She suspected a contamination but later discovered that the bacteria were producing molecules of Indigo as a part of its metabolic process. These bacteria, one day, could be used to create blue plant tissues, which could one day result in the growing of blue cotton, thus eliminating the need for the dyeing process.

This section will follow the development of blue pigments, as much as is possible, in a chronological order. However, because of overlap in the creation and usage of the various blue pigments, there are aspects that do not strictly follow each other. The history begins with Egyptian blue dating from its first usages during the 4th dynasty in Egypt (2575 – 2467 BCE) until its last known use in the 9th century, followed by Azurite which was also available during the 4th dynasty in Egypt but did not become a favored pigment until classical antiquity. Next is a

[5] The dyes created using coal tar products are known as analine dyes and the discovery of these products is often hailed as the beginning of the chemical industry (Ball, 2001). Many of the large chemical corporations we have today began as factories for creating analine dyes. For example, in 1862 Bayer was begun for the purpose of producing analine fuchsia and a variety of analine blues. Other companies such as Hoechst, BASF, and Ciba & Geigy were also born in the 19th century as a result of the new analine dye industry.

[6] The blue was discovered by accidentally changing the recipe used for creating analine magenta.

discussion of Indigo & Woad, which have been found as early as 1580 BCE and continue in use as a textile dyes. The final blue pigments which are covered are: Ultramarine, which appears in 6th century wall paintings in Afghanistan and continues in use today, especially in artificial form; Smalt whose beginning dates are unclear but probably came into use in the mid east in the 11th or 12th century; Cobalt blue which was discovered in the early18^{th} century, and Prussian blue which was also created in the early 18th century. Blue was not, however, very colorfast and in older paintings and in the hands of less experienced colorists it loses its tone. Environmental, preparatory and pigment combinations which did not account for chemical reactions between pigment ingredients also account for the loss of hue in some paintings and textiles.

Because there is such a variety of blues many of which are produced only slightly differently from each other, not every shade, tint or hue can be covered in this section. Rather, an attempt will be made to give an overview of the most historically important blues as they relate to Western civilization. A brief section including some other minor blue pigments from around the world will be included at the end of the chapter. The use of these pigments to create paint for house painting purposes will be covered in detail in Chapter Five which relates the pigments to interior design and architecture.

Egyptian Blue

Preparation

The very precise recipe for the production of Egyptian blue makes it difficult to believe that one could stumble upon it serendipitously but rather that its discovery and production was a direct result of a concerted scientific effort (Ball, 2001). Egyptian blue consists of one part lime (calcium oxide), one part copper oxide and four parts quartz (silica). These ingredients are then fired in a kiln at between 800 and 900 degrees Celsius. Higher firing temperatures (between 900 and 1000 Celsius) create greener and grayer varieties (Roy, 1993). This specific temperature range is essential to the creation of the blue and we must therefore believe that the Egyptians were able to control the firing conditions of their kilns. As a result of this process a delicate, blue substance is created which is then turned into pigment by being ground into a powder.

Egyptian blue (see fig. 4.1), or as it is sometimes known, Egyptian frit, was an important pigment to the ancient Egyptians and was developed there earlier than in other places because the artists were engaged directly in the creation of pigments (Roy, 1993). Because the creation of art and of the materials that were used had a sacred connotation, the painters were also the

priests (much like the artists/monks of later European art). Painting was seen as a tribute to the gods and a religious act, and therefore, a class of artisans developed devoted to experimentation with pigments.

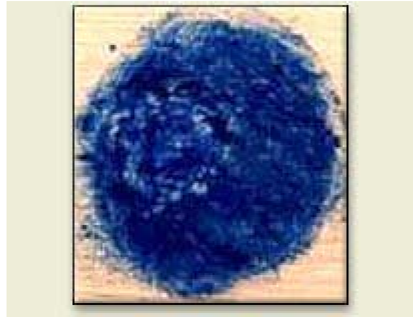

Figure 4.1
Sample of Egyptian blue. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

History & Use

The earliest examples of the use of Egyptian blue come from the 4th dynasty in Egypt (2575 – 2467 BCE) (Roy, 1993). However, it did not begin to be used regularly until the 5th dynasty (2465 – 2325 BCE). An Egyptian palette, currently housed in the Metropolitan Museum of Art and dating from the XVIII dynasty has eight wells to contain paint one of which contained traces of Egyptian blue (Birren, 1965). Another well, which is also empty, is supposed to have contained Ultramarine. The tombs of Saqqara in Egypt contain many examples of art including Egyptian blue both in the form of relief carving and painted limestone sculptures such as in a depiction of Ramses III from an early 12th century BCE painting (see fig. 4.2) (Roy, 1993). Although it was rarely ever used on pottery, some examples have been found in the tomb of Saff-el-Dawaba. There is no written information about Egyptian blue from Egyptian sources.

Figure 4.2
Head of Ramses III. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

After Egyptian blues development in Egypt, it was immediately introduced into Crete where it was used heavily (Roy, 1993). It has been found at the palace at Knossos where it was used in wall paintings. The Etruscans used Egyptian blue in what is now Italy and detailed descriptions of that use have been found in ancient Roman literature. Many samples of unused pigment have been found in shops in Pompeii and entombed with royal painters. The use of any type of blue decreases during the Greek (332 – 30 BCE) and Roman (30 – 395 BCE) periods but when a blue pigment is found, it is almost always Egyptian blue. The last known use of Egyptian blue was in a fresco contained in the lower church of San Clemente in Rome dating to the 9th century.

The tone of Egyptian blue varies based on its composition from a dark blue to a whitish blue. The pigment is completely stable in all media without regard to sun exposure, organic material, sulfur, etc. It is found in a brilliant state in its lighter blue form in the wall painting *Hunting Birds in a Papyrus Thicket* (see fig. 4.3) from the tomb of Nebamun of the 18th dynasty, (c. 1567 – 1320) which despite its great age retains the pigment's clarity.

Figure 4.3
Hunting Birds in a Papyrus Thicket at the tomb of Nebamun. From The British Museum (n.d.). Retrieved September 20, 2004 from thebritishmuseum.ac.uk/compass.

Azurite

Preparation

This mineral is usually found with a green mineral known as malachite (Harley, 1970). Because of its close association with this mineral, Azurite often has a greenish tint. In its pre-processed form it is a dark blue and can sometimes be confused with lapis lazuli. However, the pigment extraction process is entirely different.

To create the pigment, lump azurite is ground, washed, levigated and sieved; the product of this process is then ground into a powder (Roy, 1993). Fish gum, honey or gum could be added to the water to facilitate the particle separation and encourage the blue particles to sink to the bottom (Harley, 1970). A coarser grinding provides a darker blue pigment and a finer grind produces a lighter blue (Roy, 1993). In oil and tempera azurite is a stayfast pigment which is unaffected by light. However, it can be affected by sulfur fumes, which tend to darken the paint[7].

[7] The darkening trend is most noticeable in mural painting.

History & Use

Azurite, which is a basic carbonate of copper (see fig. 4.4), was available as early as the 4th

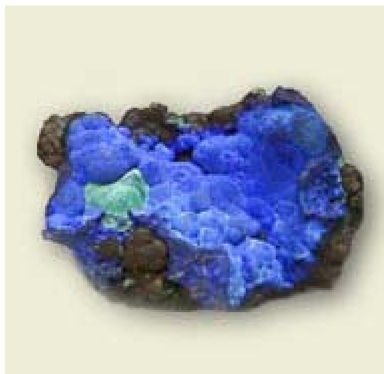

Figure 4.4
Azurite in mineral form. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

dynasty in Egypt but Egyptian Blue was much more readily available for use in pigment form (Roy, 1993). Therefore,

Azurite did not become a heavily used pigment (see fig. 4.5) until classical antiquity. It was, however, used to color soapstone ornaments as early as 4500 BCE in the Middle East (Ball, 2001). The surface of these stones would be powdered and then heated in the presence of azurite and a blue glassy material known as Egyptian Faience, would be created (see fig 4.6). The kilns creating this faience would sometimes accidentally become contaminated with sand, which would then melt into glass at the high firing temperatures required to create faience. Thus the quest for the color blue can be said to be the mother of the creation of glass, the word for which in Latin *vitrium* denotes a blue-green color. Later this glass was "dyed" blue by the use of cobalt rather than copper and this new darker blue glass was used for the perfume vessels of pharaohs and queens.

Azurite dominated painting from classical antiquity to the Middle Ages because of its lower cost[8] (Roy, 1993). As a result of its relatively low cost, it was often used as an under painting pigment before a layer of more expensive Ultramarine was applied.

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[8] Lower cost in comparison to the cost of Ultramarine

Azurite came primarily from Hungary which was conquered by the Turks in the 16th century and thereafter, became much more difficult to obtain, which resulted in Smalt

Figure 4.5
Azurite in pigment form. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

often being used as a substitute (Roy, 1993). The natural pigment was mined from the mountains in Bohemia and Germany during the Middle Ages and as a result was sometimes called "mountain blue" although the more commonly used name was "blue bice" (Harley, 1970).

In many documents the word *azur* can be taken to mean azurite specifically, or any blue in general making it difficult to distinguish if the author is referring to the pigment itself or simply blue (Ball, 2001). Things are further confused by the similar appearance of azurite and ultramarine, however, the two could be distinguished by paintmakers by being heated until red hot; upon cooling azurite will turn black, while ultramarine will
remain blue.

Azurite becomes somewhat greenish when ground finely and lacks the purplish tint of the superior Ultramarine (Ball, 2001). It also requires several layers of paint to become opaque enough to have sufficient richness for high quality works of art. When ground coarsely it produces a beautiful opaque blue, however, because of the large particle size it is very difficult to work with. The difference between finely ground and more coarsely ground azurite can be seen in The Master of the Saint Bartholomew Altarpiece's painting entitled *Saints Peter and Dorothy* (see fig. 4.7). The richer blue of St. Peters garb has been painted using the coarse grind of the

pigment while the greener tone on his cuffs and collar have been painted using the finely ground pigment giving them a greenish tint.

In the 17th century blue Verditer, an artificial version of Azurite was introduced on a commercial scale; however, nothing is known of the manner of its discovery (Harley, 1970). Before that time, the recipes for synthetic Azurite had been limited to making small amounts of the pigment for personal use. There were two varieties, a blue and a green with the green probably coming into production first. Green was the simpler of the colors to make, the production of blue sometimes being unsuccessful for months at a time because the exact process needed to create blue versus green was not well understood. The process is described in 1622 by Christopher Merret:

Figure 4.6
Amulet of Bes 1075 – 656 BCE
Egyptian Faience. From IDEA (n.d.). *Pigments through the Ages.*
Retrieved September 20, 2004, from pigmentswebexhibits.org.

> Tis a strange and great mystery to see how small and undiscernable a nicety makes the one and the other colour, as is daily discovered by the refiners in making their Verditers, who sometimes with the same materials and quantities of them for their Aqua-fortis (nitric acid), and with the same Copper Plates, and Whiting (chalk) make a very fair Blew Verditer, otherwise a fairer or more dirty-green. Whereof they can assign no reason, nor can they hit on a certain rule to make constantly their Verditer of a fair Blew,

to their great disprofit, the Blew being of manifold greater value than the Green (as cited by Ball, 2001 p. 117)

Blue Verditer never gained great popularity in fine art because its texture was very coarse and the pigment tends towards a greenish cast upon exposure to light (Harley, 1970). Many manufacturers listed the pigment as a green intending for it to be used only in combination with yellow. It did, however, become very important as a decorator's color[9] as a result of its low cost

Figure 4.7
The Master of the Saint Bartholomew Altarpiece, *Saints Peter and Dorothy*. From The Artchive (n.d.). Retrieved September 15, 2004 from artchive.com

and large production yields, however, it was not used if the budget allowed for better blues. In the 1800's Prussian blue largely replaced natural azurite in European art[10].

Indigo & Woad

Preparation

Indigo farming and processing, which was very similar to the farming and processing of Woad, is described in a letter from Francis Fettiplace at Agra to the Governor at London in 1616:

> Indigo is made thus. In the prime June they sow it, which the rains bring up about the prime September; this they cut and it is called the Newty... a good sort. Next year it

---

[9] I use the term decorator's color to distinguish colors and pigments used in decoration or design from the pigments and colors used by artists.

[10] Azurite was also an important pigment in the Far East and has been found in wall paintings from the Sung and Mung dynasties (Roy, 1993). The Japanese Ukiyo-e School used a blue pigment derived from azurite as well.

sprouts again in the prim August, which they cut and is the best Indigo called Jerry. Two months after it sprouts again,...thereof they make the worst sort; and afterwards they let it grow to seed and sow again. Being cut, they steep it 24 hours in a cistern of water; then they draw it into another cistern, where men beat it six hours forcibly with their hands till it become blue, mixing therewith a little oil; then having stood another day, they draw off the water and there resteth settled at the bottom pure Indigo (which some to falsify mix with dirt and sand); which they dry by degrees, first in cloths til the water be sunk from it and it be curdled; afterwards they dry it in round gobbets (as cited in Harley, 1970 p. 62).

The quality of the Indigo could be tested by placing the blocks into water (Harley, 1970). Those that were pure floated, while those that were weighted down with impurities (intentionally or not), such as sand and dirt, sank. The painters' pigments from Woad and Indigo were usually collected by skimming the foam off the top of the dyeing vats before any cloth had been dipped in them.

In order to be used as a textile dye, a reducing agent, which transforms the dye to a colorless substance called Indigo white, is first used as Indigo does not take well on wool (Ball, 2001). Then, upon exposure to air, the dye reverts to its Indigo color.

Synthetic Indigo

In the late 1800's synthetic Indigo was first produced and by 1913 had all but completely replaced the natural product, devastating Indigo plantations in Europe and India[11] (Ball, 2001). At first, England attempted to stymie the devastation that the production of synthetic Indigo was sure to have on its own economy (Ball, 2001). One of the ways in which it tried to do this was by decreeing that all of the country's military uniforms must be dyed with natural Indigo. However, by the time of WW I, 90% of the English Indigo industry was dominated by the synthetic alternative. Synthetic Indigo then became a sought after product in European nations as a result of the dominance of the industry by nearby England rather than far-away India.

Indigo could not be derived from coal tar as its "mother" source *indole* has no convenient ready made form (Ball, 2001). Bayer succeeded first in producing synthetic Indigo using toluene, however, the prohibitively expensive price on production using that compound made commercial production impossible. Several years later a more practical route was discovered but could not be fully utilized until clearer understanding of the targets molecular structure was understood. When, in 1883, Bayer finally cracked the code, it led the way to uncovering so

[11] As of 1870 there were over 2,800 Indigo factories in India (Ball, 2001).

much new information in organic chemistry, that Bayer was eventually awarded the Nobel Prize in 1905.

However, it was not Bayer but a Swiss manufacturer named Karl Heumann who discovered the secret to production of synthetic Indigo (Ball, 2001). He was able to produce Indigo by using inexpensive hydrocarbon compounds. In yet another fortuitous accident in the dye industry, the secret was discovered when a mercury thermometer broke in the presence of the production of phthalic anhyudride and reacted with the sulfuric acid used in that process. It took a further seven years for the process to become commercially viable at only a slightly higher cost than the natural Indigo.

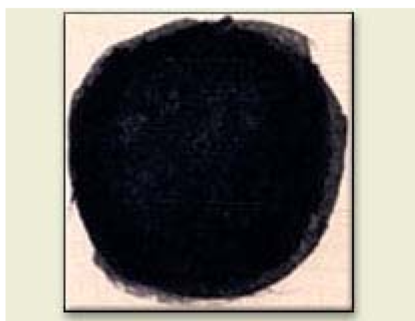

Figure 4.8
Indigo or Woad as a Pigment. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

These two pigments are almost always discussed jointly because they are comparable in tone (see fig. 4.8) and their preparation is very similar (Harley, 1970). It is not always possible for a modern reader to distinguish whether an author was discussing Indigo or Woad which creates a difficulty in separately discussing the pigments, although, the distinction would most likely have been clear to the author because of the great difference in the cost of the two substances.

Indigo is made from a plant belonging to the genus *Indigofera,*(see fig. 4.9) while Woad, also a dark blue pigment, is created from the leaves of *Isatis tinctoria* plant. Woad is found predominantly in Europe[12] while Indigo gets its name from its heavy production in India (Fitzhugh, 1997). There are other plants which produce blue dyes, such as the *Eclipta rostrate*, also known as the tattoo plant because of the dark blue dye that it produces (Finlay, 2003).

[12] It is no coincidence that its name sounds like the word weed, it is such a prolific plant that the word weed derived from its name (Finlay, 2003). The plant is so tenacious that even to this day it is still outlawed in some states. In Utah where it was planted by Mormon dyers, it is the equivalent of Kudzu in its pervasive invasiveness.

However, Indigo and Woad are the two most commonly used in pigment and textile dyes (Fitzhugh, 1997).

History & Use

The earliest confirmed use of Indigo is found on mummy bandages from graves dating to approximately 1580 BCE (Fitzhugh, 1997). It has also been found on textiles dating from around 135 CE in a cave in Israel. A tablet containing Babylonian dye recipes which dates from the 7th century is held by the British Museum (Finlay, 2003) Preparation techniques for Woad are described in Egyptian in the *Papyrus Graecus and Holmiensis* from the 3rd century CE (Fitzhugh, 1997). Vitruvius is the first in the West to mention Indigo's use as a dye in the 1st century BCE although the majority of Indian Indigo was probably used by the Greeks and Romans as a painter's pigment and not as a textile dye. Julius Caesar mentioned Woad in connection with the face painting done with the pigment by the Britons to give them a more terrifying appearance in battle (Fitzhugh, 1997). Marco Polo is the first to describe Indian Indigo and its processing to the west. He describes the processing of Indigo in India where it had been in use since 2000 BCE both as a textile dye and as a pigment. Woad was used as a dye for the clothing of priests and royalty during the Middle Ages (Theroux, 1990). In America during the 19th century, Indigo was an extremely popular color for shirts and a dyeing tub was standard equipment in most kitchens.

Woad was domestically produced in Europe but wreaked devastation on the countryside where it was produced because the plant deprives the land it grows upon of all of its nutritive value (Theroux, 1990). It was also toxic for the air and water as the dyeing process itself produces poisonous byproducts. In the 12th century Indian Indigo begins to show up on merchants account books in Europe and begins a fierce competition with the natively produced Woad (Fitzhugh, 1997). Despite European attempts to create dominance for Woad via tariffs and other economic measures, such as declaring death the penalty for the use of Indigo in France and having it declared poisonous in England, failed to stem the inevitable victory of Indigo, which eventually won out because of its higher pigment content (Finlay, 2003).

Figure 4.9
Farmed Indigo Plants. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

Indigo was an important part of trade for the early British East India Company (Harley, 1970). However, competition in this area became fierce and in the mid 1600's England had to compete with Indigo being imported from Guatemala through Spain. In North America the first Indigo plantations were begun by the British in South Carolina in the 1700's (Fitzhugh, 1997).

In the 1730's a process that came to be known as "English blue" or "pencil blue" was introduced (Ball, 2003). This process allowed for Indigo to be printed onto fabric directly using metal plates, whereas previously dyers had to use materials resistant to the dye on the portions of the cloth which were to remain colorless. By 1764 this process had been further refined to allow for block-printing rather than plate-printing. This innovation along with advances in the application of red madder dye led to the eventual development of multi-color textile printing and later to the four-color process printing.

No story of Indigo's growth in the New World is complete without a discussion of Eliza Lucas Pickney[13] (Finlay, 2003). In 1738 when she was 15, she and her family moved to Charles Town, South Carolina with the intention of beginning the farming of several plantations they had inherited from her grandfather. However, in 1739 her father who was a Lieutenant Colonel in the English army, was drafted to Antigua. From Antigua, her father would send her envelopes full of seeds of various plants with the idea that they would become the only ones with these unique and very useful crops. He sent seeds from alfalfa, ginger plants and a variety of other plants. Finally, he sent her Indigo seeds, which he believed were going to be the cash crop that

[13] The mother of political sons Thomas and Charles Cotesworth Pickney.

would solve all of the family's financial problems. After many seasons of failed Indigo crops it was finally in 1744 that she produced the first successful batch of Indigo from South Carolina.

When she had successfully sown and reaped a crop of Indigo, she presented all of her neighboring farmers with seeds enough to sow with the idea that if they were going to be a power to be reckoned with in the Indigo export business, they needed to work together (Finlay, 2003). England was importing 30,000 kilos (29.5 tons) of Indigo from the Carolinas by 1750, an by 1755 the amount had risen to 500 tons.

The 17th century marked the end of the use of Woad in pigments of any kind as it was entirely replaced by Indigo (Harley, 1970). Indigo continues to be used as a textile dye, most famously in denim and is still in use as a watercolor pigment, however, it ceased to be found in oil pigments after the 17th century (Fitzhugh, 1997).

Ultramarine

Ultramarine is the term usually used to distinguish between pigments created from genuine lapis lazuli ultramarine imported from Asia (see fig. 4.10) and other blue pigments with the same tonalities but different compositions (Roy, 1993). Lapis lazuli is mineralized limestone containing lazurite, which in the past came mainly from Asia and especially from the Kochka valley in what is now Afghanistan (Harley, 1970).

Preparation

To prepare natural Ultramarine the ground mineral is mixed into a combination of melted wax, resins and oil (Roy, 1993). That mass is then wrapped in a cloth and kneaded under a diluted solution of lye. Blue particles are then washed out and collected after settling at the bottom of a vessel while the colorless crystalline and other impurities stay behind. The particles that are washed out first are the deepest blue. Usually the mass goes through three washes, the last one producing a pale blue known as ultramarine ash. From approximately one pound of stone four to five ounces of the best quality pigment can be extracted along with three ounces each of medium quality and ultramarine ash (Harley, 1970).

There are two methods for creating artificial Ultramarine known as the indirect method and the direct method (Harley, 1970). In the indirect method the ingredients are finely ground, mixed and heated in closed crucibles at "red heat" for several hours with no air. This creates green Ultramarine, which is the base for a green pigment, in order to change this to blue Ultramarine, it is then reheated at 500 degrees Celsius and the resulting material is ground and

washed of soluble salts. The direct method simply arranges the ingredients, proportions, and temperatures in such a manner that blue Ultramarine can be obtained in a single stage.

The natural pigment can react with atmospheric sulfur dioxide and moisture, which causes it turn a greyish-yellow and is known as “ultramarine sickness.” However, normally it is a “comparatively permanent pigment” (Roy, 1993 p. 44). Synthetic Ultramarine is susceptible to the same acids and sulfurs as the natural pigment.

Figure 4.10
Ultramarine in Pigment Form. From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

History & Use

The first appearances of lapis ground into pigment are from the 6th and 7th century wall paintings in Baniyan, Afghanistan (Roy, 1993). The haloes around the two great Buddhas destroyed by the Taliban government in 2001 were colored with lapis lazuli from local sources (Finlay, 2003).

Ultramarine of a worthy quality appears to have been introduced to Europe during the 13th century (Ball, 2001) and the height of its use was during the 14th and 15th centuries in illuminated manuscripts and Italian panel paintings (see fig. 4.11) (Roy, 1993). Medieval

painters used gold leaf, Vermillion and Ultramarine in abundance. These costly pigments were used not because they combined to create naturalistic color schemes, but rather precisely because they were expensive and the sacrifice of money required to purchase them was considered tribute paid to god. Eventually, Ultramarine's costliness was viewed no longer in terms of a sacrifice to God, but rather a representation of the wealth of the patron.

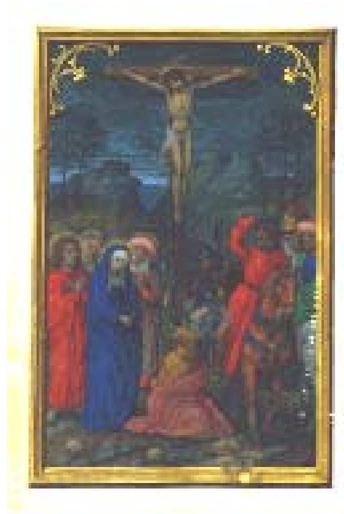

Figure 4.11
Simon Bening. *The Crucifixion, 1525 – 1530.* From The J. Paul Getty Museum (n.d.). Retrieved August 30, 2004 from getty.edu/art/collections/objects

Ultramarine was highly revered as the most beautiful of all colors. Cennino Cennini said, "Ultramarine blue is a color, illustrious, beautiful, and most perfect, beyond all other color; one could not say anything about it, or do anything with it, that its quality would not still surpass" (as cited by Ball, 2001).

As a result of its complicated preparation process and the great distance it had to travel from mine to artist, the pigment itself became as expensive as gold in Europe and was often specified in various artists' contracts requiring supply of lapis and gold by the patron (Ball, 2001). The price situation was only worsened by the smaller than demand supply of the pigment to Europe (Harley, 1970). On account of its great expense a less costly pigment was often used for the layers of underpainting. The blue fabric in Giovanni Bellini's *Madonna of the Meadow* of 1505 (see fig. 4.12) is underpainted with azurite, before a final layer of Ultramarine was laid down (Roy, 1993). Also, possibly as a result of its expense, the Virgin Mary was left unpainted in a panel by Michelangelo while he had to wait for the pigment to be supplied by the patron as he could not afford the expense himself (Finlay, 2003). However, before his patron was able to

Figure 4.12
Giovanni Bellini. *Madonna of the Meadow,* 1505. National Gallery in London. From The Artchive (n.d.). Retrieved September 15, 2004 from artchive.com.

give him the needed pigment he left Rome to carve his David and never returned to finish the panel.

This devotion to Ultramarine would change somewhat with the Renaissance because of the use of oil as a binder for the pigment rather than the egg yolk, which was used during the Middle Ages (Roy, 1993). When oil is used as a binder, Ultramarine becomes more transparent and less brilliant. It often had to be mixed with lead white to make it more opaque and thereby lost some of its chromatic intensity. Because of this, Ultramarine was no longer considered the most beautiful of blues and the only pigment acceptable for use in prestigious works. This opened the way for artists to use a wider variety of blues. For example, in Titian's *Bacchus & Ariadne* (1520 - 1523) (see fig. 4.13) the sky and the draperies are Ultramarine, but the sea is Azurite, which is a less expensive pigment.

Until the 1600's Venice was the most prestigious source for buying lapis. Venetian art used more Ultramarine than other Italian cities because it is a port city and Ultramarine was therefore easier to obtain (Harley, 1970). The pigment is not as common in Northern European painting because of the expense incurred in transportation over the great distances it had to travel from port of entry to art shop (Roy, 1993). Ultramarine, therefore, did not normally make its way up to Northern Europe, but Azurite could and therefore, became the blue pigment of choice in that region.

After the 1600's, the English had a large share in the lapis market as a result of British merchants who traded in the eastern Mediterranean (Harley, 1970). In the 19th century, sources were

Figure 4.13
Titian. *Bacchus & Ariadne*, 1520 – 1523. National Gallery in London.
From Olga's Gallery (n.d.). Retrieved September 27, 2004 from
abcgallery.com/t/titian.

discovered near Lake Baikal which allowed for cheaper importation of the product and, therefore, an upsurge in its use in the early 19th century until it was largely replaced by its synthetic counterpart (Roy, 1993; Harley, 1970).

The beauty of the pigment, however, continued to allure artists and patrons alike. Therefore, the government of France began a search for a way in which to domestically produce the pigment (Roy, 1993). The Société d'Encouragement pour l'Industrie Nationale called on the

citizens of France to develop a less costly version. They offered a monetary award for anyone who could synthetically produce Ultramarine for less than 300 francs an ounce[14].

The first results of France's search led to the development, in 1802, of Cobalt blue by Louis-Jacques Thénard, which in turn paved the way for the introduction of Cerulean blue (Ball, 2001). However, what the French wanted, was not alternatives to Ultramarine, but a cheaper, domestically produced, synthetic version.

In 1828 Jean Baptiste Guimet successfully developed a process for creating synthetic Ultramarine that he could then sell for 400 francs a pound, while the natural pigment sold for 3,000 to 5,000 francs per pound (Roy, 1993). For this discovery, he was awarded 6,000 francs by the Société. Shortly after this award was given C.G. Gmelin, a professor of chemistry at University of Tübingen submitted a claim stating that he had invented the process for production of synthetic Ultramarine before Guimet. A heated debate ensued from which Guimet eventually emerged victorious and began producing the pigment commercially in 1830 at Fleurien-sur-Sâone in France.

F.A. Köttig began producing synthetic Ultramarine for the Meissen Porcelainworks shortly thereafter, and soon after that there was production all over France and Germany (Roy, 1993). The introduction of more affordable synthetic Ultramarine caused a great decline in the use of natural ultramarine.

International Klein Blue

International Klein Blue (see fig. 4.14) was patented in 1960 but is not its own separate pigment (Harley, 1970). Yves Klein, although not an artist of the greatest talent, became obsessed with creating the most beautiful blue possible on canvas. He noticed that the ground pigment of Ultramarine when mixed with a binder lost some of its beauty. In 1955 he came upon a M60A a synthetic fixative resin which, when thinned, could be used as a binder without affecting the Ultramarine's chromatic strength. He worked with Edouard Adam, a chemical manufacturer, for over a year to perfect the binding recipe, which gave his paint its unique matte, velvety texture.

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[14] This was not the first time a government organization put out a reward for the development of a pigment. In the beginning of the 18th century, the Society of Arts and Sciences in London offered a reward for anyone who could discover the secret ingredients in a Parisian orange varnish (Finlay, 2003). Also, in the 1780's the French government offered a reward to Guyton de Morveau if he could find a safer white pigment than the lead white, which was currently being used (Ball, 2001).

Figure 4.14
Yves Klein. *IKB74*, 1958. San Francisco Museum of Modern Art. From SFMOMA (n.d.) Retrieved September 27, 2004 from collections.sfmoma.org.

Smalt

Preparation

Smalt was derived when cobalt ore was roasted to create cobalt oxide and melted together with quartz and potash or added to melted glass (Roy, 1993). When the cobalt ore was roasted, all of the arsenic was drawn off in the form of white smoke and was settled in a wooden tunnel (Harley, 1970). When the cobalt oxide, ash and glass combination was poured into cold water the molten mixture broke into particles, which were then ground into a powder and elutriated. Then water was added to the pigment and it was packed into barrels. When the barrels were opened, the pigment had hardened to such a point that it had to be broken with hammers again before it could be used.

The pigment was divided into three categories based on particle size: fine, medium and ordinary (Roy, 1993). The finest of the grindings produced a pigment that was a deep violet-blue and the ordinary grade was a very pale blue. When made correctly Smalt is a stable pigment; it is, however, more stable when used with water-based media such as fresco than when it is used in oil based media due to the very close refractive index of oil and Smalt pigment (Roy, 1993).

History & Use

Smalt, a pigment created from ground blue glass (see fig. 4.15), was first detected in European use in the 15th century although it is possible that it was in use in Europe earlier (Roy, 1993). The blue glass was created using the element cobalt, which was mined as cobalt arsenide (Harley, 1970). This was the first pigment to be created using the element of cobalt before scientists isolated the element. Georgius Agricola (1494 - 1555), author of De Re Metallica and

Figure 4.15
Smalt in Pigment Form. . From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

a physician working with cobalt miners, wrote of the dangerous effects of working with cobalt arsenide. Workers wore masks and leather gloves to prevent inhalation of gases and contact with the arsenic, which would eat into their flesh.

In the Near East, Smalt was most likely in use several centuries earlier because important sources of cobalt were located in Kashan, Iran, thereby giving the area easier and earlier access to the pigment (Roy, 1993)

Smalt became very widely used by Venetian glassmakers beginning in the 15th century (Roy, 1993). In the 16th century, high quality cobalt sources were discovered in the Netherlands, which then began to produce the pigment for European consumption (Harly, 1970). Later their monopoly was rivaled by English Smalt production as well. In the 17th century when Azurite became scarce, Smalt was often used as a substitute in painting, especially where a particularly intense blue is not required. Smalt continues in use as a pigment although on a very limited scale, having been almost entirely replaced by Prussian blue.

Prussian blue

Prussian blue (see fig. 4.16) or potassium ferric ferrocyanide, was introduced in the early 1700's and was the first truly modern pigment (Fitzhugh, 1997). Its creation is the result

Figure 4.16
Prussian blue in Pigment form. . From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

of a happy accident in which a color scientist in Germany named Ghislain Diesbach was attempting to create a bright red pigment and stumbled onto a dark blue. An alchemist named Dippel was producing animal oil used for medicinal purposes, which in its preparation was distilled over potash (Harley, 1970). The potash byproduct, which was an alkali, was then thrown away as waste. Diesbach finding himself out of alkali borrowed some of Dippel's potash byproduct waste, and combining his ingredients in the usual manner to create a crimson color was disturbed to find his concoction was very pale. When he concentrated the solution it turned a deep blue color. In discussion with Dippel he discovered the tainted nature of the alkali he had used and thus the recipe for what would be known as Prussian blue. He began marketing the new blue in 1724 creating the modern artificial pigment industry[15] (Theroux, 1990).

[15] Prussian blue was the only blue pigment that John Ruskin would let his pupils at the Working Men's College use in their paintings (Theroux, 1990).

Cobalt blue

Until the element cobalt was isolated by the Swedish scientist Brandt in the early 18th century, it was not certain which was the element of cobalt ore that provided the blue color seen in cobalt compound based pigments (see fig. 4.17) (Harley, 1970). This discovery allowed Louis-Jacques Thénard to develop Cobalt blue pigment in 1802 in a bid to create an alternative to the extremely

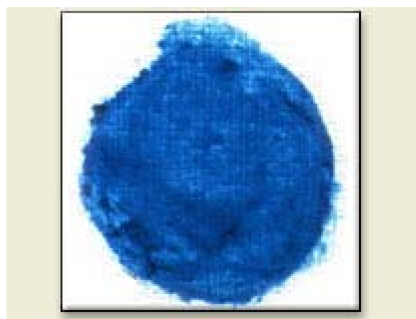

Figure 4.17
Cobalt in pigment form. . From IDEA (n.d.). *Pigments through the Ages.* Retrieved September 20, 2004, from Pigmentswebexhibits.org.

costly Ultramarine (Ball, 2001).

Although Cobalt blue left some people unsatisfied and continuing to search for a way to synthetically produce Ultramarine, to others, it was exactly what they wanted (Ball, 2001). J.W.M. Turner was introduced to Cobalt by George Field, the leading colorist of his day, and was one of the first artists to use it. *J. Varley's List of Colors* of 1812 did not include Cobalt in the list for use in painting; Cobalt was, however, on the top of the list in the 1816 version (Harley, 1970). Sir John Everett Millais' *The Bridesmaid* (see fig. 4.18) of 1851 made heavy use of the new synthetic pigment. Van Gogh has also been recorded raving about the color. In a letter to his brother Theo, Van Gogh is quoted as saying, "I've new ideas and new means of expressing what I want; the better brushes are going to prove a great help, and I'm very excited by those two colours carmine and cobalt. Cobalt - is a divine colour and there is nothing as fine for putting an atmosphere round things" (28 December, 1885).

Figure 4.18 .
John Everett Millais. *The Bridesmaid*, 1851. Fitzwilliam Museum, Cambridge, UK. From The Art (n.d.). Retrieved September 15, 2004 from artchive.com.

Phthalocyanine Blue

Phthalocyanine blue, or as it is often called Phthalo blue, was another blue discovered accidentally (Ball, 2001). In 1928, during the manufacturing process of a chemical called phthalimide at the Scottish Dyes Company (later part of ICI), a blue substance was noted to have been produced. This "contaminant" was later understood to be phthalocyanine and to be closely affiliated with the plant pigment chlorophyll. This substance was used to develop a dye in 1935 and Scottish Dyes called their dye "Monastral Fast Blue."

As a result of the colorfastness of this new chemical blue, it came to be used in four-color process printing and nearly eliminated the problem of fading and color contamination that plagued the printing industry before (Ball, 2001). Also as a result of its fastness, it began to be used as a coloring agent in the lake pigments in modern paints.

Other Blues

Cornflower Blue

This blue was discovered by Robert Boyle (dates) and was recommended in painting manuals based on the strength of Boyle's reputation alone (Harley, 1970). This blue was created using the petals of the cornflower and was notoriously impermanent and therefore, never produced commercially.

Charron Blue

Charron blue is the name for a mixture of cobalt blue and barium sulfate that was popular with Impressionist artist Paul Gauguin (1848 – 1903) (Ball, 2001).

Hanadaino

In Japan, a pigment known as *hanadaino,* which is a light blue tinged with pink, is favored in printmaking (Theroux, 1990). It is a relatively stable blue pigment and is used in fabric for farm workers' and fishermen's clothing, shopkeeper's aprons and kimono. When it is used in Japanese Kabuki the color is given to villains and supernatural creatures.

Logwood

The blue produced under this name was a result of a red dye that turns blue in the same manner as Turnsole (Harley, 1970). It came from America in the form of blocks and thus also earned the nickname blockwood. Logwood was mainly used for textile dyeing until it was made illegal as a further effort by the government of England to protect the native Woad industry. However, even without the ban by the English government, its longengevity was doomed by its tendency to revert back to its original red color.

Tekhelet

The Hebrew God told Moses that the one of the fringes of their garments should be dyed a blue called *tekhelet* (Ball, 2001). This blue was made by combining the secretions of male and female rock snails (*Truncularioipsis trunculus).* The male secretes Indigo and the female secretes dibromoIndigo (a bromine enhanced Indigo). However, the secret to the creation of this dye was lost in the 8th century and the fringes of the prayer shawls have not been color since that time.

Turnsole

Turnsole, otherwise known as folium, is a pigment that is extracted from a plant identified as *Crozophora tinctoria,* which is found in Southern France (Ball, 2001). The seeds of this plant are collected and gently squeezed, and the juice that is extracted in this manner is then soaked up by a cloth, which was allowed to dry saturated with this color. When the color was needed a portion of the cloth was moistened and the color was released. The habit of storing these dried cloths soaked in color between the pages of books is possibly the origin of the name folium. This blue was specifically used in manuscript illumination, being particularly suited for that use as a result of its natural transparent finish.

Turnsole is a member of a vegetable class that turns a variety of colors depending upon the acid content to which it is exposed (Ball, 2001). There is therefore, a red turnsole, a purple turnsole and a blue turnsole. The juice is red in acid, purple in a neutral solution and blue in an alkali[16].

Conclusion

Rather than being an exhaustive list of every type of blue known to have existed, this section has touched on the pigments that have had the greatest impact. The history of blue's evolution was followed from ancient Egypt to the modern chemical lab. In order to understand how these blues were used and why they were used in that manner, it was integral to thoroughly research the pigments. The blues that have been used, their methods of preparation and various individual characteristics gives a fuller understanding of why particular blues have had historical impact, which will be covered in the next chapter.

[16] A vegetable from the same class is used on the paper in Litmus tests to determine acidity (Ball, 2001).

CHAPTER FIVE: SYMBOLIC BLUE

Introduction

This chapter will trace the meteoric rise in importance of the color blue from a marginal color in art and a lowly color in textiles to the color of one of the most important figures in Christian religious art and the color of the cloth of kings. These changes in blue's status and meaning are not divorced from the technological advances that were made in pigment and dye manufacture and therefore, this chapter will recall some of the history of the pigments that was covered in the previous chapter.

Blue is a color that has touched almost every culture through history in some form or another. Each society has developed a distinct response, whether positive or negative, to the hue as well. In the multi-cultural society in which we find ourselves during the 21st century, in the United States and the global community that is forming as a result of the Internet and faster transportation, it is especially important that blue's symbolism in different cultures is understood.

The academic robe of the philosopher in Ancient Rome was blue; it is the color of holiness in Judaism, the color of the Krishna for the Hindus (see figure 5.1) and representative of heaven and immortality in China (Mahnke, 1996). Alexander Theroux (1990) most succinctly summarizes the wide variety of symbolism attached to blue:

> It's the symbol of baby boys in America, mourning in Borneo, tribulation to the American Indian, and the direction south in Tibet. Blue indicates mercy in the Kaballah, and carbon monoxide in gas containers. Chinese emperors wore blue to worship the sky. To Egyptians it represented virtue, faith and truth. The color was worn by slaves in Gaul. It was the color of the sixth level of the Temple of Nebuchadnezzar, devoted to the planet Mercury. In Jerusalem a blue hand painted on a door gives protection. A blue spot placed behind a groom's ear in Morocco thwarts the power of evil, and in East Africa blue beads represent fertility. The gem hyacinth gives second sight. It is a superstition in Syria to wind blue string around the necks of animals to protect them from death. And the symbolic color of St. Patrick's Day in Ireland is not green but blue (p. 71).

This chapter will include a history of the color blue's role in painting and sculpture. Also included in this chapter will be a discussion of blue as it used symbolically in life. Examples of

its various meanings in clothing and uniforms, orders of knighthood, cultural symbols, blazon and as representative of other senses in synasthaesia will be given. The realm of architecture and interiors will be addressed briefly here and will be reviewed in greater detail in Chapter Five. These topics will be covered together in a historical progression, as extricating blue's usage in art from its usage in life is sometimes impossible.

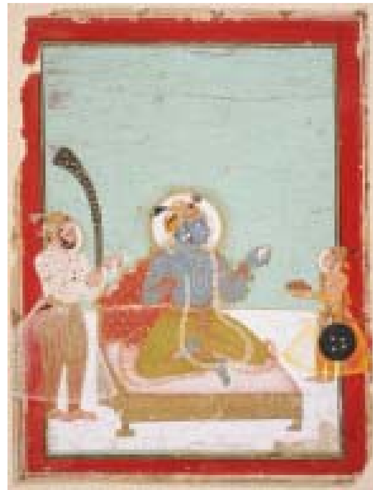

Figure 5.1
Kota Master. *Maharao Bhim Singh of Kota Attending Krishna as Brijnathji*, 1719 – 1720. Philadelphia Museum of Art. From Philadelphia Museum of Art (n.d.) Retrieved July 1, 2004 from philamuseum.org.

In Egypt, Greece and Rome during ancient times and in European history until the Renaissance, color was used symbolically and not creatively (Birren, 1965). All use of color had a distinct meaning that was not created by the artist but rather used to communicate with the audience. This is not to imply that each color had a specific meaning that could be universally interpreted regardless of context (Gage, 1993). The colors that were chosen were used with a specific intent either by the patron or by the particular society in which it was painted. Some colors communicated specific meanings to certain groups of people, such as alchemists, while others simply demonstrated wealth and the sacrifice of money in the creation of the painting.

Any attempt to create a dictionary of universal color symbolism is thwarted by the many contradicting interpretations of color given even within the same cultural groups at the same time (Gage, 1993). Although there was much written on the representations of color, they are far from being agreed upon. For example, some ancient Greek colorists understood blue to be

associated with summer while other associated the color with autumn. Theories were advanced throughout the ages from Ancient Greece to the Renaissance in an attempt to associate specific colors with shapes or elements (such as air, water, etc.), but the variety of combinations is almost endless and no overarching consensus can be found.

The use of high quality colors was considered an act of tribute to the gods in Egypt and pigment making was therefore left to the priests (Gage, 1993). It has been argued that European use of fine materials has reflected the attitude of sacrifice to God, rather than sacrificing a lamb, patrons were sacrificing their money in creating the finest image possible to be dedicated towards religion. However, Ball believes that in Europe during the middle ages, the "use of precious materials, such as gold and ultramarine, does not simply imply a wish to show piety by lavishing expense but reveals the hope that the supernatural potency of the work will thereby be enhanced" (Ball, 2001 p. 85). Visitors to the Arena Chapel in Padua (see fig. 5.2) were promised that one year and 40 days would be removed from the time they had to stay in purgatory simply by visiting the chapel. This frescoed interior, which holds such power, required the use of potent materials.

The artist's adherence to a policy of using color as a devotional offering, or as an enhancer of potency, ended during the Renaissance (Ball, 2001). The new goal became the simulation of the natural world. Rather than communicating through formulaic representations of subject matter, the artist was attempting to imitate the world as he saw it around him. Color as purely

Figure 5.2
Giotto. *Arena Chapel in Padua*, 1303. From Oneanta (n.d.).
Retrieved July 15, 2004 from employees.oneanta.edu.

representation sprang to the forefront again with the beginnings of abstraction and one can argue that blue is used equally symbolically by Wassily Kandinsky (1866 - 1944) and Piet Mondrian (1872 - 1944) as it was during the time before the Renaissance.

The History of the Use of the Color Blue

The Egyptians had a close bond with the color blue as it not only represented to them the heavenly realm as seen in the sky, it was also one of the colors used in painting as representative of the goddess Isis, wife of Osiris and one of the most important deities in ancient Egyptian religion (Birren, 1963). Outside of its connection with Isis, blue is most often seen in Egyptian painting as clothing and in object d'art as the blue glazed pottery known as faience.

The most commonly used colors in early Greek paintings are blue and yellow, despite the lack of color terms to distinguish between the two pigments (Gage, 1993). Painters of Greek funerary stelai tended to use the combination of a blue ground and green relief painting in their works. Blue was also used as a background color for architectural friezes while the figures were painted a contrasting color, which made them easier to distinguish from the background at a distance.

Apelles, a legendary painter in Ancient Greece supposedly developed a four-color system of painting using black, white, red and yellow (Birren, 1965). Pliny, hailed Apelles as an arbiter of good taste and restraint, resisting the contemporary fashion of using "vulgar" colors (Gage, 1993). The advice of Pliny was largely ignored in design and architecture; blue was often used as the background color against which a relief carving would be displayed such as in the Temple of Aphaia at Aegina. Though we often cannot see the color that was applied by the ancients, the use of the color blue in architecture has been established from traces of pigment left on the original architecture (Pastoureau, 2001).

The exclusion of blue from the early four-color palette has often been explained as simply a result of lack of distinctive color terms for black and blue[17], or by the fact that black can be made to appear blue (Gage, 1993). This argument is further supported by this same black for blue substitution technique in other times and cultures (Pastoureau, 2001). During the Middle Ages in Europe, blue and black also often played the same role in heraldic colors as well as in Christian imagery, while in Peter Paul Rubens (1577 – 1640) painting *Samson and Delilah* (c. 1609) the blue of the servant's jerkin is not actually blue at all, but rather a combination of red lake, black

[17] Blue was viewed somewhat casually as simply a form of black, almost like a shade of gray. Democritus gives the recipe for blue as being a combination of black and pale green (Ball, 2001).

and lead white[18] (Ball, 2001). This does not completely eliminate the possibility of the usage of blue though, as there were many varieties of blue pigments readily available that were used by contemporary artists in different media (Gage, 1993).

Nietzsche argues that blue and green both were avoided by Ancient Greek painters because these colors dehumanize nature (Ball, 2001). However, Ball proposes that the limited palette may have been used during certain times as the Greeks began to experiment with Chiaroscuro and perspective. Eliminating excess coloration would have allowed the artists to sublimate the use of color in the attempt to gain mastery over the world of light, shadow and depth.

It seems unlikely that blue, a pigment long used, would fall into disuse solely for aesthetic reasons, creating a color system which would not be repeated in later antiquity (Gage, 1993). Kertsch style ceramics of the fourth century, which have been connected with works of Apelles, contain Egyptian blue, as do painted pieces, which are considered to be copies of Apelles works. In Pompeii, the excavated city shops revealed as many as 29 different pigments that were available for use and a 1st century painted representation of a Greek painter showed 16 divisions in his paint box, not four. The question then arises, if Apelles considered it appropriate to include blue in his paintings, why would he not use a chromatically strong blue rather than an impression of the color created by certain usages of black? It is possible that Pliny had simplified matters in an attempt to make a more dramatic point about the restraint of the ancients in comparison with modern decadence[19].

Since ancient times, colors have been associated with the elements. The Greeks associated red with air, black with earth, white with water, and yellow with fire, and the Upanishads, as discussed earlier, also linked colors to various elements (Gage, 1993). It was not until the time of Leone Battista Alberti (1404 – 1472) that blue became associated with the element of air, while green was linked to water.

Colors were sometimes associated with seasons or with shapes as well. There was, however, no consensus as to which colors should be representative of which seasons or shapes; some thought blue was the color of autumn, others the color of summer. There was no agreed upon logic behind the associations and therefore they were never particularly useful as universal means of symbolic communication.

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[18] This substitution of black for blue was completely rejected by the French Romantic painter and student of color, Eugene Delacroix (1798 - 1863) who criticized the interchanging of the two colors as being unequal and the substitution of black for blue leaving the canvases "earthy, dull and lifeless" (as cited in Ball, 2001 p. 172).

[19] The argument for the restraint and good taste of previous societies has been repeated throughout history and this harkening back to the "good old days" continues through the present.

This same ambiguity is carried forward into the Middle Ages where symbols were applied rather fluidly and sometimes in complete opposition to each other (Gage, 1993). Generalizations about the significance of medieval color symbolism are difficult to justify. The same colors could be used to represent purity or sin, heaven or hell, or any other number of contradicting religious ideas.

Basil of Caesarea, (ca. 330-379) also called Basil the Great, a bishop of Caesarea, and a leading churchman in the 4th century, wrote of blue that it was a restful color (Gage, 1993). Despite his endorsement, however, blue remained a marginal color until the Middle Ages, used only sparingly and not acquiring the same symbolic significance attributed to red, black and white, the three primary illustrative colors of the time.

In the 11th and 12th centuries in Europe blue went from being a relatively obscure color to being declared in some literature as the most beautiful color in existence (Pastoureau, 2001). Until the 12th century blue was in use as a minor color, however, in a short period of time blue's value was rediscovered and it began its ascent to a position of great importance. Mahnke (1996) asserts that in Christian art, beginning in the 12th century, blue was associated with purity and therefore was used for the cloak of the Virgin Mary[20]. Phillip Ball (2001) has argued, however, that blue was used in the robes of the Virgin, not because of the color's connection with purity, but rather because it was the most expensive pigment, more expensive than gold, and therefore should be applied to the holiest part of the work.

Pastoureau (2001) links the evolution of the color blue in Mary's robes to the colors used in mourning. Mary was a tragic figure always portrayed as mourning either the future loss or the recent crucifixion of her son. Dark colors portrayed this anguish and sorrow. This association with mourning colors comes from the contemporary custom during the 11th and 12th centuries of wearing dark clothes when in mourning for a friend or relative. By the 12th century, blue became the only color considered appropriate for Mary's mourning attire. The blue became lighter and more intense as its use in stained glass increasingly became the model for artists. This light blue reached the peak of its perfection in Abbot Suger's Abbey Church of St. Denis and became known as "St. Denis Blue." The artisans who worked on the stained glass for this church carried this blue with them as they traveled, to other projects such as Le Mans and Chartres thereby spreading this symbolic usage throughout Europe.

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[20] The association between the Virgin and the color blue became so pervasive and long lasting that Agatha Christie in her novel *Peril at End House* published in 1942 refers to a woman as wearing a dress of "Madonna blue" (p. 55).

When Abbot Suger (1081 – 1151) remodeled St. Denis, he left an account of the project in which he specifically notes his donation of the blue glass used in the windows (Gage, 1993). The blue glass (see fig. 5.3) would have been the most expensive item used in glazing the estimated 90 to 100 windows attributed to his patronage. The choice of blue glass over the almost equally costly white glass for the windows was probably a result of its growing association with the robes of the Virgin, as well as, its connection to the gem sapphire and the religious reverence due to that particular gemstone.

Blue French stained glass during the early 12th century was an extravagantly expensive item (Gage, 1993). Its great expense resulted from the materials from which it was made. A common coloring agent used in Gothic glass was imported cobalt, which was high in price, chosen because while it would have been possible to color the glass using inexpensive local copper and manganese, the results would have carried a weaker effect. The preciousness of the blue that was used in the glass was a result of using materials even more expensive than cobalt itself: recycled roman perfume bottles made of opaque blue glass and ancient Roman mosaic tiles, which were becoming more and more difficult to obtain. The rarity of these items and the cost, therefore, of using them made them all the more desirable to glaziers and patrons.

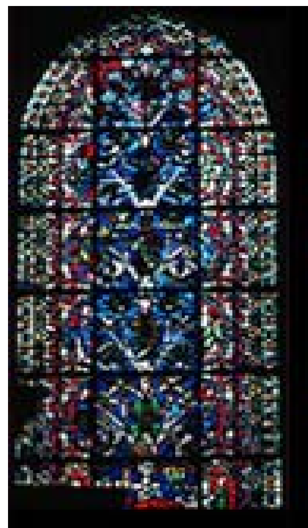

Figure 5.3
St. Joshua Tree, St. Denis, France, 12th century. From Images of Medieval Art & Architecture (n.d.). Retrieved September 27, 2004 from vrcoll.fa.pitt.edu/medart/image/France/sdenis/windows.

The beauty and desirability of these windows affected the language used to describe this blue and the objects associated with it[21] (Gage, 1993). During the early medieval period, the term sapphire could be used to refer to distinctly opaque items such as cloth dyed with Indigo and had no connotations of clarity or transparency. However, Gage believes that *saphirus* evolved into a term for the transparent gemstone in place of the originally used designation of *iacinthos* because of the translucence and gem-like quality of these sheets of "sapphire" glass.

During the Middle Ages sapphires became known as the "gem of all gems[22]" (Gage, 1993). It was believed that the walls of heavenly Jerusalem were built with oval sapphires, rectangular emeralds and pearls and that God himself revered the stone. It was further believed that among the sacred virtues attributed to the sapphire was the ability to "protect its bearers from harm, release them from prison or other shackles, reconcile them with God and dispose them to prayer, to cure disease of the body by cooling the inner organs, prevent excess of perspiration, cure sores when powdered and mixed to a paste with milk, to clear eyes and cure headaches and ailments of the tongue" (Gage, 1993 p 73).

In Christian art blue has also been representative of divine darkness (Gage, 1993). The light of creation is red and the darkness from which it is separated is blue. The Monastery of St. Catherine in Sinai contains the mosaic *Transfiguration of Christ* in which Christ appears in a blue mandorla, representative of divine darkness, which is inspired by the biblical passage saying, "a cloud and darkness were about him" (Psalm 96/7,2) and that transcends light and therefore becomes less dark as it moves away from him. In this instance, the divine darkness operates in the same fashion as divine light, casting blue darkness on the draperies of the apostles surrounding Christ. Blue is also found in representations of divine light. In Hosios Loukas Monastery in Beotia, Greece, a mosaic shows red flames of the Holy Spirit within white rays, which are edged with a dark blue.

Mary is not the only Christian figure to dress in blue, although her raiment is usually completely blue, tinged only by white or gold (Ball, 2001). St. Peter is also usually represented wearing a yellow or brown cloak through which a bluish tunic can be seen. Blue's elevated status as a result of its association with the Virgin Mary and other religious figures, caused it to be used as representative of worth when worn in portraiture (Pastoureau, 2001). Although blue

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[21] Color theory was also affected by the blue stained glass at St. Denis and Chartres. Viollet le Duc was so moved by the glowing of the blue in the glass that he assumed it was because transparent blue radiated more strongly than other colors (Sowers, 1966). He named this property "positive halation". His theory of radiation was accepted as truth for over a century before it was challenged.

[22] Today, Sapphire is the most popular colored gemstone.

became a royal color before his reign, Saint Louis (Louis IX, 1215- 1270) was the first king of France to be depicted consistently in blue robes as a way of paying homage to the Virgin Mary and was followed in this fashion trend in England by Henry III (1216 – 1272)[23].

The rise to royalty of the color blue can be explained by several factors. First, its connection to the Virgin, second the advice to the French Capetian Monarchy by Abbot Suger and St. Bernard that they adopt it as their symbolic color and, finally, an advance in the dyeing process which allowed a rich stable blue to be produced as opposed to the dull, washed out greys that had been producible previously (Pastoureau, 2001). The use of the color by the monarchy produced a great interest for this color for use in clothing by the wealthy patrician classes whereas, before dyers were able to generate this new, beautiful, clear blue fabric, it had been mostly the color of peasants and workers clothing.

Golden lions on a blue background were part of the herald of Geoffrey Plantagenet of Anjou (1082 – 1125) in the 12th century, and the words for those two materials *or* (gold) and *azur* (blue) became two of the most used technical terms in blazon because they represented the most precious metal and the most costly blue (Gage, 1993). Geoffrey Plantagenet's herald was not the only one to include blue, a great increase was seen in the use of blue in heraldry from the mid 12th century to the 15th century as shown by a statistical analysis done by Pastoureau (2001). Only five percent of coats of arms dating from the 1200's contain blue whereas by the 1400's that had increased to approximately 30 percent. This increase coincides with blue's rise in fortune in religious art.

The increasing importance of the color blue in art and heraldry is also followed by a greater mention in literature of the time (Pastoureau, 2001). Arthurian literature was interwoven with knights who were represented by a single heraldic color. Each of these colors had a specific meaning, such as a red knight signifying some connection with evil or other worldliness. However, until the late 13th century there were no mentions of blue knights. When these knights did finally make their appearance in Arthurian legends in the 14th century they were associated with loyalty, friendship and courage and eventually were elevated to the status of heroes.

In 1348 King Edward III of England was given a blue garter, of which he was very proud, by the Fair Maid of Kent at a ball and, as a result, was inspired to create the highest order of knighthood, the Knights of the Garter whose color was, naturally, blue (Fehrman & Fehrman,

[23] Blue had been used as a royal color in Ancient Egyptian where a blue helmet with a golden serpent was used as a symbol of royalty.

2000). This order consisted of Edward and 26 of his loyal knights and was considered by him to be a recreation of the Knights of the Round Table. Blue thereafter became the color of champions resulting in "blue ribbon" winners.

A pejorative outlook on the mixing of pigments coming down from at least the times of Ancient Greece seemed natural to the medieval painter as his pigments were very costly and entirely symbolic. However, the taboo of mixing pigments was a great detriment to the Renaissance painter in his quest to paint scenes, as they would be seen in nature (Ball, 2001). Crowd scenes, for example, could become highly repetitive using only the limited number of pure pigments on any given artist's palette. The problem of color was brought to a head as a result of the properties of recession and advancement of the colors available. Any figure painted in yellow tends to leap forward in the painting as a result of the brightness of the color while any figure painted in blue tends to recede into the background as a result of the depth of that color. This problem was brought to a head by the fact that while Judas is represented wearing yellow and therefore catches the eye easily, Christ is most often portrayed wearing blue and therefore sinks into the background.

Different artists struggled against this limitation of the palette in a variety of ways, for example, Da Vinci disposed of this problem by using only a variety of midtones for his paintings rather than the more brilliant highs and lows in order to give his paintings a more unified appearance. This resulted, however, in paintings which have a somewhat smoky quality known as *sfumato* such as *The Mona Lisa*. He achieved these midtones not by mixing colors, but rather by painting a darker color, blue or brown over the entire canvas before he began painting[24].

Blue's embroilment in artistic controversy did not end there, Thomas Gainsborough's (1727 – 1788) painting *The Blue Boy* (see fig. 5.4) was painted in 1779 as one side of an artistic argument with Sir Joshua Reynolds (1723 – 1792) regarding the appropriate usage of the color blue in portraiture (Theroux, 1990). Reynolds argued that cool colors could never be used with a positive effect in portrait paintings and Gainsborough replied with his painting of a figure dressed entirely in blue.

Gérard de Lairesse in his 1738 book *The Art of Painting in All Its Branches,* associates the color blue with duty (Birren, 1965). This association is clearly demonstrated by its common use

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[24] From the 11th century onwards a blue or black ground was painted on a surface in preparation for overpainting. Thus painters worked from dark to light (Gage, 1993). This practice continued into the Renaissance and was advocated strongly be Da Vinci and greatly enhance the smoky effects he desired in his paintings.

in many cultures as the color of police and military uniforms. With the introduction of synthetic dyes in the 18th century, blue became easier to produce and police uniforms changed from black to blue and the standard black business suit was replaced by a blue one (Achenbach, 2003). Blue became a color of patriotism in the red, white & blue and became more closely connected with masculinity then ever before.

Blue was a favorite color of Vincent Van Gogh (see fig. 5.5) and is often featured in the correspondence with his brother Theo (Birren, 1965). In a letter reenacting an imaginary conversation with painter Manet he writes to his brother of the outrage he felt while discussing the color blue with his fellow artist "In the Name of God, the mountains were blue, were they? Then chuck on some blue and don't go telling me that it was a blue rather like this or that, it was blue, wasn't it? Good – make them blue and it's enough!" (Correspondence, 19th Sept 1889). His passion follows from his belief that color is paramount in painting and must be given full reign.

Wassily Kandinsky believed that all color has inherent significance in art harking back to pre-Renaissance symbolism (Birren, 1965). He further believed there were only two important divisions in color: that between light and dark colors and between warm and cool colors. Kandinsky subscribed to Goethe's theory regarding blue and yellow color poles. He stated in his writings that he believed cool colors had softer edges, and therefore blue was associated with the

Figure 5.4
Thomas Gainsborough. *The Blue Boy,* 1779. The Huntington Library. From The Huntington Library. Retrieved September 28, 2004 from huntington.org.

circle and violet with the oval, while warm colors had sharper edges, leading to an association between red and the square and orange and the rectangle[25]. His love affair with the color blue is evinced in his statement, "The power of profound meaning is found in blue....Blue is the typical heavenly color. The ultimate feeling it creates is one of rest. When it sinks almost to black, it echoes a grief that is hardly human" (Kandinsky, 1912 p.38).

Figure 5.5
Vincent Van Gogh. *The Starry Night,* 1889. MoMA. From The Museum of Modern Art (n.d.). Retrieved August 3, 2004 from moma.org/collection.

In 1911, Kandinsky and fellow artist Franz Marc (1880 – 1916) started an almanac entitled *The Blue Rider* named after a 1903 painting by Kandinsky which contained a blue figure on horseback (Ball, 2001). They eventually appropriated this name for their circle of artists and when Marc died in the First World War, Kandinsky formed another group consisting of him and three other artists and called it *The Blue Four.*

James Bond films of the 1960's began a craze for blue in men shirts, as this was the color of his shirt in many of the films (Theroux, 1990). Blue jeans, which get their color from an Indigo-based dye, have become the most common type of pants worn, elevating in status greatly since the 1950's when they were considered low class and unacceptable for anything but dirty work.

[25] Gestalt Psychology, a form of psychology coming into great practice and study during this time period, commonly refers to warm colors as "hard" and cool color as "soft" and have stated that warm colors are dominant over cool ones (Birren, 1976).

Alfred Hitchcock (1899 – 1980) once gave a dinner party in which all of the foods served were blue, thereby demonstrating both the incredible popularity of the color and his eccentricity in a single evening[26] (Theroux, 1990).

Blue has symbolized many things throughout the ages and it has been considered both a warm and a cool color. Today, a majority of Americans and Europeans name blue as their favorite color and overwhelmingly associate it with peace and tranquility, although also with sadness, cold, depression, security, comfort, sobriety and contemplation (Mahnke, 1996).

[26] Blue coloration in food has, however, consistently been shown to have a negative affect on the appetite of the consumer. Foods which are dyed blue are almost always reacted to with revulsion (Mahnke, 1996).

CHAPTER SIX: LINGUISTIC BLUE

Linguists Berlin & Kay proposed in *Color Terms* that all languages develop color words in the same order: black, white, red, yellow or green, the remaining of that pair, and then finally blue (Kay & McDaniel, 1978). They further postulated that the development of these color terms is part of a universal categorization system that reflects properties intrinsic in human color perception. Overall there are thought to be between eight and eleven basic color terms as defined in *Color Terms.* These color terms are not rigidly defined, discrete entities but rather part of a fluid language used to describe color, blue-green is, therefore, not a contradiction but the acknowledgement of that fluidity and the difficulty in setting boundaries between one color and the next[27].

The development of these color terms mimics the pattern of discovery of pigments beginning with those that the earth can supply most readily such as charcoal for black, chalk for white and the ochres for red and yellow (Ball, 2001). According to George Chaloupka's book entitled *Journey in Time* about color words in the aboriginal languages in Arnhemland in Australia there are eight terms for paint color (Finlay, 2003)[28]. Grass and sky were often considered to be the same green color, a description used by the Egyptians and there is a relatively paltry assortment of color terms for the blue-green range of colors (Theroux, 1990). In the *Illiad* and *Odyssey*, Homer used only three color words: red, white and black (Pastoureau, 2001). Other Greek authors have referred to flowers, which are blue by a variety of color terms ranging from red to black.

The lack of specific color terms for blue in ancient Greek led to a serious debate in the 19th century as to whether or not the ancient Greeks could, in fact, see blue or whether our modern

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[27] Kay and McDaniel term this lack of discrete boundaries as a "fuzzy set". When membership into a group cannot be acknowledged as being greater or less than others' membership in a group, such as in the case of a person termed a gourmet, Charles may be more of a gourmet than Fred and less of a gourmet than Anne, creating a fuzzy set for the word gourmet. Color terms operate under the same principles where one color can be seen as being more or less blue than another (Kay & McDaniel, 1978).

[28] The term "blu" was not introduced until the 20th century, however, when it came into the language as a way of discussing the color of missionaries' laundry hampers (Finlay, 2003).

ability to detect this color was a result of our intellectual evolution and advancement (Pastoureau, 2001). Pastoureau and others now dismiss this argument as being "false and indefensible" (2001 p. 25). It seems rather, that the ancient Greeks had very specific words to refer to blues as related to the various objects with which they were associated, such as *kuanos* (the equivalent of cyan) to refer to the sky and sea, rather than having any blanket term such as "blue" to represent the hue in general (Ball, 2001).

In the 1st century BCE the Latin language expands its color terms from five words to over 70 (Gage, 1993). Eight of those terms are used to differentiate between varieties of blue alone. The increase in the amount of color words indicates a corresponding increase in usage of a wider variety of colors and, therefore, a greater need for specialized terminology. This early use of blue specific terms further exposes as false the narrow view that the ancients were unable to see this color.

The development of color terms can be somewhat difficult to trace, as they are not very specific and sometimes refer to characteristics outside of the actual chroma (Gage, 1993). For example, scarlet was often used during the Middle Ages to signify an expensive type of cloth, which could have been dyed in many colors. However, due to the value of that cloth it was often dyed with the most costly dye available which was a bright red. Eventually, the meaning of the word scarlet became interchangeable between the material and the color and now is used to refer to a bright red color.

In the same manner, linguists have found the word *perse* to refer to colors from light blue to dark red (Gage, 1993). The word has been found referring to everything from a light purplish-blue to a rust color. In Northern Europe during the later Middle Ages it was certainly used to refer to a dark blue, known in Flemish as *satbblaeu*, which was very costly to produce.

During the middle ages there was great confusion concerning the word *sil* which was listed as one of the colors in Apelles four-color palette (Ball, 2001). Since there was difficulty believing that he painted without yellow or blue the term was interpreted to mean both or either depending on the intentions of the reader. This confusion in interpretation led to further obfuscation in usage until the term came to stand for anything from yellow ochre to ultramarine.

The word blue has many connotations in the English language, such as, being a trade worker ("blue collar"), a style of American Music ("the blues"), variable microtonal lowering of the third, seventh, and occasionally fifth degrees of the major scale ("blue note"), rarely ("once in a blue moon"), and architects' plans ("blue prints"). Included among the many examples

available are also a “blue plate special,” to talk until you are “blue in the face,” and the ubiquitous “blue light special.”

Joseph Roppolo (1953) gives a short list of some of the many different meanings of the word blue which he compiled using *Webster’s Dictionary* and *The American Thesaurus of Slang*, among other resources. He relates them as follows:

> A *blue law* is a law set up for the rigid control of morals and conduct. A *blue pig* is an establishment for the sale of illicit liquor. A *blue nose* is a reformer, a hypocrite, or a Nova Scotian potato. *To be blue* is to be melancholy, drunk, off-key, or (chiefly of women) really or affectedly learned, intellectual, or pedantic. A *blue* is a smoker who does not inhale. A *blue boy,* a *bluebelly*, or a *bluecoat* is a policeman. A *blueskin* is a thief. A *blue gown* is an immoral woman, or, more specifically, a prostitute. *Blue-blazes* is hell. *To be in a blue funk* is to be incapacitated through extreme nervousness. A *blue book* is a book listing the aristocracy, a booklet in which college examinations are written, or a book of pornography. A *blue word* is an oath or a curse, and *to make the air blue* is to curse and swear. A *blue gag*, is a risqué story or joke, and *blueology* is the art or practice of singing *blue songs* or the “science” of preparing off-color material for presentation on the stage (p. 12).

The term for a melancholy mood (“the blues”) was made popular by Washington Irving in 1807 and is a shortened form of the original phrase “blue devils” which predates him (Fehrman & Fehrman, 2000). The word is not always universally understood to have the same meaning, however. In Germany be careful when you say that you are blue because it means that you are completely drunk (Mahnke, 1996). In Paris at the end of the 20th century asking for “the blue” would tell the barrista you were searching for absinthe (Theroux, 1990). In the United States gin was referred to as “the blue ruin”[29].

Blue is often associated with high quality objects or people, a tradition which began with King Edward III Knights of the Garter whose official color was blue. To have “blue blood” is to be connected with royalty; “blue chip” refers most commonly to an outstandingly worthwhile stock, athlete or other object (Fehrman & Fehrman, 2000). To be “true blue” is to be completely loyal a saying which, it has been suggested, arises from the color fastness of blue dye, a blue fabric was one that would not stain or change colors (Jacobs & Jacobs, 1958). This saying may also arise from or in connection with the qualities of the blue knight as he appeared in the Arthurian legends where he always represented a loyal, friendly knight (Pastoureau, 2001).

When the term “bluestocking” is used to refer to a person he or she is understood to be pedantic. This connotation developed in the early 15th century in Venice, where citizens of

[29] One of the great ironies in all of this is that the American Temperance League adopted The blue cross was as their symbol (Theroux, 1990).

varying classes and education levels were differentiated by the color of the stockings they were allowed to wear according to the Sumptuary Laws. This tradition carried through until 18th century England (Fehrman & Fehrman, 52).

In today's language, blue can be used as a "marker of intensification" giving the phrase associated with it an exaggerated sense of extremity (Morris, 1976). This use can be found in phrases such as "talking a blue streak" or feeling in a "blue funk," the most extreme form of "funk" to be had. The origins of this word as an intensifier are shrouded in mystery, but Morris hypothesizes that it has to do with the limitlessness of the blue ocean or the blue sky. This sense of lack of boundaries then carries over into its adjectival meaning of beyond the pale or limitlessness.

As a result of its association with hell fire, as in "blue blazes" it has also been used in conjunction with foul language, in other words, to be using "blue talk" (Roppolo, 1953). This connotation with off-color language and behavior outside the bounds has led to the word "blue" being connected with pornography as in a "blue movie," a pornographic film or a "blue book" which is a pornographic novel or magazine.

Perhaps most relevant to the industry of Interior Design and Architecture is the term "blue print." This term started out not being related to either profession, but rather as a technical term related to the dyeing of fabrics in the early 17th century (Ball, 2001). Patterned printing became very popular during this time and a specialization developed among the dyers for those who could print patterns on fabric using Indigo or Woad. Dyeing then could no longer be done simply by dipping the fabric into a vat but required the use of resist patterns, where wax or other dye resistant materials were applied to the fabric where no dye was wanted and then removed later leaving a pattern dyed in blue. This type of patterned printing then became known as "blue printing" and was elevated to the status of painting rather than dyeing.

CHAPTER SEVEN: PSYCHOLOGICAL IMPACTS OF BLUE

Psychophysiological Impacts

There is a great deal of disagreement regarding the validity of the results in a majority of the studies that have been done on human psychological reactions to color (Fehrman & Fehrman, 2000). Kurt Goldstein, a pioneer in the field of color psychology, is most often cited when referring to the reaction of humans to different colors. He worked with subject groups consisting of patients with diseases of the central nervous system, testing their physiological reactions to color in rooms, fabric, color samples and lights. His work is often cited by those wishing to draw conclusions about reactions to colors. However, his studies consisted of subject groups of three to five patients with no control for hue, saturation or texture of the color to which they were exposed. Despite the problems inherent in his experiments, they have been largely accepted as truth and have greatly affected the way in which color is used and the advice that "color experts" such as Faber Birren give regarding that usage.

Goldstein's study, for which neither numerical results nor statistical analysis were ever offered, seemed to show that red resulted in more severe symptoms of nervous central damage, trembling, shaking and involuntary movements, while blue reduced the symptoms (Fehrman & Fehrman, 2000). He then postulated that red caused greater anxiety while blue had a calming affect. Despite the fact that his work has not been confirmed independently since he conducted those first experiments, his theories have become embedded in our cultural consciousness. Having been influenced by the acceptance of these results, Birren (1963) believed that a blue which tends towards green can have a soothing effect on students and chronic hospital patients and therefore recommended its use in those situations.

Faber Birren in his 1963 book *Color for Interiors* stated that blue's effects could always be measured in a negative direction while red's effects could be measured in a positive one. For example, when placed in a blue environment, he believed that the subject's blood pressure and respiration rates would decrease, along with the rate at which the subject blinked. He based his

assumption on the 1958 dissertation by R. Gerard titled *Differential Effects of Colored Lights on Psychophysiological Functions* in which statistical significance was found in the physiological differences between subjects placed under blue light versus subjects placed under red light.

In a study done by Erwin et. al in 1961 on the effects of colored lights on human subjects, however, the results are not nearly as clear (as cited in Fehrman & Fehrman, 2000). Many further studies have resulted in a wide variety of conclusions and in general come no closer to resolving the question of psychophysiological reactions to color. With the lack of significant findings, Fehrman & Fehrman were then driven to complete their own study of human reaction to colors. In this study the hue and saturation of the pigments used were carefully controlled, as well as, the daylight conditions. Forty-two subjects were exposed to red, blue and yellow environments where their pulse rate and galvanic skin responses were measured. Fehrman & Fehrman found no evidence to support the idea that red is more arousing than blue, but rather that the colors equally affected the test subjects.

Differentiation in warm and cool colors in a room has been said to effect the estimation of time by subjects placed in those rooms (Mahnke, 1996). In a study done by Linda Clark two groups of salesmen, not wearing watches, were placed in two separate rooms, one painted in a warm color and one in a cool color. Those in the warm colored room overestimated the amount of time they spent in the room and those in the cool colored room underestimated the time spent. This would seem to create an argument for considering blue as a color for waiting rooms.

However, in a study reported by Porter and Mikellides the same theory was tested on two audiences, one seated in a blue theater and one in a red (as cited in Mahnke, 1996). The two groups were given identical lectures, however, the audience in the blue theater reported feeling bored and listless, and, on average, believed they had spent more time in the lecture than those seated in the red theater.

Another variation between subjects placed in a warm colored room and those seated in a cool colored room is the perception of temperature. Porter and Mikellides report that a Norwegian study showed people tend to set the thermometer an average of 4 degrees higher in a blue room than in a red. In a study by Hans Scheurle (1971) test subjects reported feeling significantly warmer in a red room than in a blue room even though the temperatures were exactly the same (as cited by Mahnke, 1996).

Color Preference

Mahnke (1996) states that when blue is used in ceilings it has a celestial feeling but can become oppressive if the color is too dark and that on walls the color can create an impression of spatial depth if it is dark but will remain distant if it is light. Dark blue on floors can create a sense of substantiality and light blue creates a sense of ease of movement, almost like floating. Mahnke (1996) notes that, "Pale blue is refracted sharply by the lens of the eye and therefore tends to cast a haze over details and objects in the environment. This may cause distress to some people confined to a particular area for a long period" (p. 69). He then hypothesizes that as a result of this, if blue is applied to large areas it can become somewhat bleak and depressing, while it is very effective as an accent in the medium and darker tones. For this reason, Birren (1963) believed that pure blue should be omitted from school and hospital use.

There have been many studies regarding color preferences and the relationship of certain colors to "pleasantness" and "unpleasantness" (Fehrman & Fehrman, 2000). The idea that certain colors are happy, certain colors are active or that certain colors are strong, for example, has been widely accepted by authors, fashion experts and interior designers. Most of these studies have shown red, blue and green to be the most favorite colors and orange and yellow to be the least favorite colors.

When value, hue and saturation were taken into account in studies, however, the results were quite different (Fehrman & Fehrman, 2000). Rather than a broad preference for red, blue and green it was shown that colors with higher saturations were met with higher approval than those with low saturation. The size of the sample shown also had an effect upon the subjects' reaction to that color. In a study done by Fehrman & Fehrman including 21,000 subjects, blue-greens were found to be most preferred and yellow-greens to be least preferred. Again, these results were affected by the saturation level, the brighter the color the more positive the response.

The Helson-Lanford study of 1970 showed that the reaction to a color would be greatly affected by the background upon which it is seen or the other colors against which it is viewed. Yet another study showed that the shape and size of light sources could affect the preference levels of the subjects. All of these studies taken together appear to demonstrate only the difficulty in accurately testing for color preference and the fluid state of those preferences. A further difficulty in testing reactions to color and color preferences is separating the biological reaction to a certain color and the learned cultural reaction to a color. As of yet, there have not been significant findings in this area from which to draw a conclusion.

Color and Food

People are disinclined to eat food which is dyed a color in contrast to the natural state of the food item, such as blue bananas and have an inherent suspicion of all foods in the blue-green category, most likely as a result of that colors association with mold and spoilage (Fehrman & Fehrman, 2000). The revulsion felt towards blue-green food made it impossible for some subjects to even try food of that color and some of those who could try foods of that color felt physically ill afterwards despite the fact that the only difference in the food was the color.

Conclusion

While I believe it is very important to consider the psychological implications of color use when designing a room, it must be remembered that many of these effects are still controversial and cannot then provide absolute guidelines and must be taken accordingly.

CHAPTER EIGHT: BLUE IN DESIGN

Introduction

No surface in an interior environment is without color (Miller, 1997). Space and structure in an interior are defined by the colors that are placed upon them or given to them by the materials used to create them. The appearance of recession, advancement, heaviness and ethereality of elements within a space are determined in a large part by the way in which colors are applied to them. As Miller (1997) states, “The physical structure holds the building together, but color defines the visual structure” (p. 13).

This section will give a history of the use of the color blue in interior design beginning with its use during the Egyptian period and moving through until the present day. Sharp delineations between time periods cannot always be made and some overlap must be allowed because the use of the color blue did not change sharply with each historical period but rather evolved with the styles as the world around the styles changed.

Historical Design

Classical and Creative Use

There can be said to be two distinct phases of color usage in interior design and decoration, the first being classical use and the second being creative use (Birren, 1963). Until the time of the Renaissance all color was used within a system of cultural guidelines that were strictly adhered to and were meant to communicate symbolically to the audience while completely divorced from personal taste and expression. While all symbolic representations are not universally understood for all cultures, the use of the same color in connection with the same architectural elements within a culture help us to understand that there was some code of conduct regarding their usage. The creative usage phase has been around for a comparatively brief period of time, some 600 years beginning with the Renaissance. The creative phase finds color used for personal reasons of taste and also a falling away from the use of basic or unmixed colors into

increasingly irreproducible combinations meant to delight the eye rather than to communicate with the mind.

This is not to say that the creative usage phase was completely divorced from anything outside the personal taste of the designer or patron. The choices of colors by designers were greatly influenced by technological developments in pigment production. Another influencing factor in wide spread usage of a particular shade of blue in interior design was patronage by nobility. Trends in fashion and trends in decoration and design most often travel from the top down of society, therefore the taste of the few greatly affected the decision-making of the many.

Ancient Egypt

Ancient Egyptian color usage is relatively easy to study because of the great number of items of household furniture, architectural models, and painted representations of objects that were carefully preserved in Egyptian tombs (Pile, 1997). While the objects that are found in preserved tombs are most likely not the same as the objects and designs used in everyday domestic architecture in Ancient Egypt they provide a basis for studying Egyptian attitudes towards color usage.

Also, as a result of the dry climate, more applied paint has been preserved for us to study first hand (Birren, 1963). The Egyptian temples are filled with an abundance of symbolic colors. The Egyptian temple the, Mountain of the God of Ur, was constructed in four phases, representing the dark underworld, the habitable earth, the heavens and finally the sun. Each phase represented by paint of a different color, blue being used as the color of the heavens. This same connection between blue and the color of the heavens can be seen in the ceilings in these temples which were painted a deep blue and then superimposed with paintings of the constellations to refer to the night sky.

Bright reds and blues were often used in contrast with the black ebony wood used in furniture (Pile, 1997). Columns were painted with stripes of red, orange, green and blue. Cloth tapestries consisting of blue and white stripes were often hung in interiors in front of a contrasting orange background demonstrating an early understanding of the law of contrasts[30]. Walls were made of

[30] Alberti laid out the law of color contrast used by the Renaissance painters. The Impressionists learned from the color theorist Michel-Eugene Chevreul (1786 - 1889) that colors look brightest when paired with their counterparts (Birren, 1976). This can be seen as applied in Renoir's *Boating on the Seine* in which orange is paired with blue making both pigments look more vivid.

a mud brick, which were whitewashed and the ceilings were then painted a deep blue clearly dividing the space between the earth and heavens.

Ancient Greece and Rome

In ancient Greece, Apelles was famous for his four-color paintings (none of which survive today) and the use of other "vulgar[31]" colors was discouraged and frowned upon by theorists (Ball, 2001). The disapproval of Pliny himself, however, had little effect on decorators who continued to use bright colors in their designs. Until the 19th century, the use of color in Greek architecture was vehemently denied by architectural historians, and the role of color in ancient architecture was not fully understood until the 20th century (Birren, 1963). Despite protests that the beautiful forms of classical Greek architecture would be ruined by the wholesale application of bright, primary colors it has been confirmed that Greek columns were painted in stripes of red and blue[32] (Finlay, 2003) and that the wide panels in the Parthenon were painted Stellar blue (Birren, 1963). Birren (1976) related a story of this denial in which two archeologists enter a temple hoping to negate, once and for all, the idea that color had been used. When one archeologist detected traces of color in the cornice work the other one immediately ordered him to come down and to never speak of it again.

This use of color in what seems to be such a contrary fashion to the beauty and restraint used in the design of the architecture can be explained by referring to the classical usage of color, in which the application of color was not a matter of personal taste, but rather of cultural prescription (Birren, 1963). When Frank Lloyd Wright referred to the painters "choice" of colors in ancient Greek architecture, he called them the first at "inferior desecration" (as cited by Birren, 1963 p. 10). We must avoid applying contemporary creative color usage standards of aesthetics to the critique of the past as the Greeks were compelled to use symbolic colors to communicate in the same way that all stop signs must be red in order to have the cohesiveness necessary to understanding. Parts of Greek buildings were uniformly associated with certain colors in order to communicate.

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[31] Pliny definition of vulgar colors does not include an exact list of which color were acceptable and which were not, but is rather a more amorphous reference to eastern influenced colors which tended to be bolder and brighter than the more earthy ochres, black and white which were supposedly used by Apelles (Ball, 2001).

[32] Columns were not the only elements in Greek architecture to employ an alternating red/blue color scheme (Wilber, 1942). This alteration between red and blue would be carried throughout the exterior architecture. This was not a matter of choosing an aesthetically pleasing color scheme, but rather the prescription for color placed on the architect by society.

Some knowledge of Roman coloration can be inferred from Greek architecture, as Greek craftsman often came to work in Rome, it follows then that there was some influence from Greek coloration on Roman coloration (Birren, 1963). The majority of knowledge regarding the usage of color in Ancient Rome, however, comes from the excavation at Pompeii and Herculaneum (Pile, 1997). Entire homes were buried under a layer of protective ash, which allowed modern scholars access to unchanged interiors dating from 79 C.E. From these well preserved interiors, as well as other excavations, it has been learned that both the Romans and the Greeks used colored marbles in their interiors (Gage, 1993). Interior mosaics dating from the 2nd century BCE contained bright blues, reds and greens. Mosaicists from Pompeii and Herculaneum used vibrant blue glass in the borders of their creations. However, blue continued to be a fairly marginal color in Ancient Roman interiors (Pile, 1997).

Byzantine

The use of bright color in Persia and India, which was so heavily disdained by Pliny as being overly florid, was a great influence on the art and design of the Byzantine period (Ball, 2001). This bolder use of color was brought westward to Europe during the crusades. The interior spaces upon which the most attention was lavished during this era were Christian churches (Pile, 1997). The majority of the decorations in these interior spaces were mosaics. The three predominant colors that were used in these mosaics were blue, green and gold.

Although the Byzantine churches, cathedrals and castles that survive today have mostly returned to the natural color of the stone from which they were built, medieval paintings reveal that bold colors were widely used in domestic interiors (Pile, 1997). There is also evidence, although no scholarly agreement, that the interior stone of churches and cathedrals were possibly painted in these same strong colors. The majority of the colors that we see today in medieval churches and cathedrals come from the extensive stained glass in their interiors. The dominating colors used in stained glass are blues and reds with a variety of other colors used in smaller quantities.

Red and green were the most expensive colors to have in textiles, during this period, and therefore a proliferation of these colors, as representations of the owners wealth, would be seen in the interiors thought worthy of portrayal while blue was a less used color (Gage, 1993). These colors would have been prohibitively costly for the middle class, however, and little documentation exists of what colors were used in those interiors.

Spain

Spain was under Moorish control for 800 years between the 8th and 16th centuries and Spanish interior coloring was greatly affected by Arab and Islamic influences (Pile, 1997). Therefore, the use of color as seen in the rest of Europe cannot be assumed to have been paralleled by usage in Spain.

During the Mudejar period, palace interiors were explosions of colors with both painted plasterwork and elaborately patterned geometric tiles in a variety of colors. This abundance of color can be seen in the interiors at Alhambra in Granada which, although still retaining the color of their tile work have lost most of the paint that once covered the carved plaster surfaces (Bayon, 2000). Enough of the paint remains however, from which the infusion of colors that were once present can be inferred.

Walls in Spanish renaissance domestic interiors were white plaster with a tile dado panel (Pile, 1997). The tiles in these panels were often Azulejos, blue and white tiles, produced in the south of Spain, especially in Cordoba. They were decorated either with elaborate geometric designs (once again reflected the influence of the Moors) or with more European nature or narrative scenes. The use of these blue and white tiles found its way to Spain through Islamic influences as ceramic work using dark and light blue glazes had become elevated to the status of a fine art in areas such as Kashan and Saltanabad (Wilber, 1942). The ceramics produced in these areas were intended mainly for architectural decoration in the form of dado panels and inscription bands, and their usage in this manner followed architectural influence from the Arabic world into Spain. During what is known as the Desornamentado period in Spanish architecture, King Philip II commissioned a palace known as El Escorial (1562 – 1584) from architect Juan de Herrera (Pile, 1997). The rooms in this palace consisted almost entirely of white plaster walls with dado panels made of azulejos.

Renaissance

Paintings from the Renaissance period often show restrained color in the interior architecture accented by bolder usage of color in textiles (Pile, 1997). However, it was with the Renaissance that color would gain the level of importance it deserved (Birren, 1963). With this period the creative usage of color began and the spaces became livelier and fuller as a result. One favorite Italian brocade pattern during the high Renaissance consisted of purple and yellow-green ornamentation on a blue violet background. Deep cobalt and what has come to be known as Della Robia blue after the famous family of artists were used in great abundance in interiors.

France

Beginning in the 16th century with Catherine de'Medici (1519 – 1589), wife of Henry II of France, color usage became more closely connected with royal fashion and was handed down from the elite to the classes below (Birren, 1963). Catherine de'Medici introduced two colors that were immediately popular in interior design and are known as Medici Blue and Medici Green. With the rise of Madame de Pompadour (1721 – 1764), mistress to Louis XV, Sevres Blue and Pompadour Blue were introduced to the decorator's palette. This feminine influence in decorator's colors carried through to Napoleon's wife Josephine and during her reign as an influential figure in design the color palette tended towards more muted, pastels such as her Grey Blue while her husband preferred the bolder red, white and blue of the French Tricolor with Azur Blue being his most favored of colors in decor.

Early America

Many of the tones used in interior design during the period known as American Colonial (1607 – 1781), were natural in color, owing to the ready availability of natural dyes; this despite the fact that brighter colors were available in paint which expanded the range of applied pigments to include: lemon yellow, deep peacock blues and rich ochre (Fehrman & Fehrman, 2000). These colors were most likely used in limited quantities because of the difficulties in producing large amounts of paint of a consistent color. When these brighter colors were used in these interiors, the coloring was often uneven. This is not to say that color was never used on the exterior of domestic dwellings during this time period, Newton (1943) referenced colored acquatints and mezzotints which, while showing the majority of houses in natural colors, do depict the occasional home painted in robin's egg blue.

After the American Revolution, a new color was introduced by the new country called "Vernon Blue" because of its use in Mt. Vernon's great banquet hall (Fehrman & Fehrman, 2000). The White House would also show an interest in the color and have a room designed with deep blue silk wall coverings called "The Blue Room," to accompany the red and green rooms also in the mansion. A deep, intense blue which is associated with the Federal style is Williamsburg blue, which gets its name from its heavy usage in the historically preserved Williamsburg, VA.

17th & 18th Century Europe

Before the 17th century, Indigo was the only pigment able to be utilized in paint for house decoration and it continued in use through the 19th century (Bristow, 1996). It was available for use in oil paints; however, it produced only a dull greyish-blue tone. Indigo pigmented paints did prove to be lightfast enough that they could be used as exterior paints. Indigo pigmented paint was used in combination with white paint to create decorative finishes on windows trim, doors, post rails and nearly any other painted surface.

Indigo was used in two manners to create paint, the first was by grinding the pigment directly into a base of white paint, the second and cheaper method was to use the blue froth from the top of the dyeing vats for which either Indigo or Woad were suitable (Bristow, 1996). The paint produced using the second method was not as high quality and was known as *blue balls* or *flory*. In the mid 17th century *flory* was included in a list of painting materials for work at both Whitehall and Greenwich Palaces. Into the late 17th century, Indigo was still marketed by some paintmakers as the preferred blue paint.

Another paint which was used for decorative purposes in house painting, especially before the English Civil War (1642 – 1651), was Smalt, however, it could not be used in the traditional manner of mixing in oil because of its close refractive index to oil (Bristow, 1996). The only way in which it could be used in oil was by mixing it with lead white which produced a very pale shade of blue. The most common manner of application for Smalt was a method which was known as “strewing” in which the ground Smalt pigment was “strewn” upon a ground of lead white pigment laid down wherever the blue was wanted. Then the Smalt was leveled with a feather assuring equal coverage over the entire desired area. It was then pressed down with a linen cloth and finally the extra, loose pigment was blown off with a bellows.

This technique obviously did not allow for large amounts of coverage but was used, rather, as a decorative accent on clock faces, small panels and moldings (Bristow, 1996). Strewn Smalt can be seen on the enriched ceiling beams and entablature of the Queen’s Cabinet at the Queen’s House at Greenwich and on the door cases at Tamworth Castle in Staffordshire. Accounting records also include mention of strewn Smalt being used for the armorial hall at Whitehall Palace (destroyed by fire in 1698). However, the most common use of strewn Smalt was on exterior iron work. Examples of this can be seen on the iron gates of the Royal Hospital, Kilmainham in Dublin and the iron work on the Tulip Stairs at the Queen’s House. This difficult technique was largely abandoned with the introduction of Prussian blue.

Azurite was also produced for use as pigment in house paints. The paints produced using this pigment have been found on the ceilings of Cardinal Wolsey's Closet at Hampton Court and the Tudor Chapel at Whitehall (Bristow, 1996). In the late 1680's Verditer was noted in some painter's catalogs as only being suitable for color mixing but by the 1700's natural Azurite had been replaced by its artificial counterpart.

During the 17th and 18th centuries, Blue Verditer, one of the first commercially produced pigments for house painting, became highly used in decorators paint colors, both in distemper and oil, (Ball, 2001). It was prized chiefly for its low cost and for its ability to be produced in mass quantities. One problem with colored paints had been that they were produced in small batches and therefore varied in tone from bucket to bucket. This made painting in color on a grand scale a very rare occurrence because it was difficult to produce enough similar paint to cover a large surface. However, the ease of production of Verditer in quantity allowed greater expanses to be covered in a paint that would provide an even tone.

Many English manors of the time had walls covered in Verditer based paint, such as the Great Drawing Room of Bowood House in Wiltshire, which was built during the 1750's and destroyed during the 1950's after its upkeep became too expensive. It can be found in the entablature, door cases and other elements at Ham House in Surrey built in 1638 (Bristow, 1996). Verditer was also utilized by paint makers in making French Grey. In an aqueous medium this pigment was used to create the bright blue dye for wallpapers in the late 18th century. Verditer later gave way to Prussian blue in popularity for decorative painting (Harley, 1970).

Prussian blue by the mid 18th century became the most highly favored of painters' pigments although it did tend to become greenish with time (Bristow, 1996). Prussian blue was also not suitable for use on lime plaster because of its tendency to react with alkali and become yellowish. This incompatibility kept alive the market for other blues; however, Prussian was overwhelmingly the painter's favorite pigment. The production centers of Prussian blue were located in London, and Berlin. This pigment was combined with lead white in varying quantities to produce blues ranging from very light to a deep purplish shade. For example, "skye blue" was produced when five pounds of lead white was combined with ½ ounce of Prussian blue, versus "navy blue" which was produced by combining the same amount of lead white with 2 ounces of Prussian blue. A cheaper form of Prussian blue pigment called "wet blue" or "damp blue" was available on the market and was simply a wet or damp form of the dry powdered pigment.

A distinction must be drawn between the product represented by the name of a paint color and the product represented by the name of a pigment. Paint always begins with a pigment being mixed into a base of white except in the rare cases where a pure pigment is used directly for a deeper, richer effect (Bristow, 1996). As we have seen, the pigment Prussian blue can be used to create a variety of paint colors such as "skye blue" or "navy blue." By the same token, a paint bearing the name "Prussian blue" does not necessarily mean it was created with the pigment Prussian blue, only that the end color resembles the pigment Prussian blue and it could conceivably be mixed having used other pigments in combination to achieve a match of the pigment.

In the early 18th century, a very popular mode of ceiling decoration emerged called "clouding" (Bristow, 1996). This, as the name implies, was a treatment that encompassed painting a ceiling to create the illusion of looking up at a cloudy sky. Brighton Pavilion, home for the playboy Prince Regent George (later to be King George IV of England), had numerous ceilings decorated in this manner such as the Saloon, Billiard Room, Music Room and Breakfast Room among others. This was also a very popular treatment for theaters as it created an atmosphere of the outdoors.

Robert Adam (1728 – 1792), a prominent Scottish architect and designer during the Georgian period became well known for his use of subtle colors including a newly popular dusky blue called Wedgwood blue (see fig. 8.1). Wedgwood blue is named after the porcelain ware or Jasperware produced by the company of a man named Josiah Wedgwood (see fig. 8.2). Its blue was so distinctive that in the style of Madame Pompadour's "Pompadour Rose" and "Pompadour Blue," it was named after him. Adam would often insert pieces of Jasperware into his designs and also used colors known as "Opal Blue" and "British Blue" in his designs (Birren, 1963). He used the lighter blues for background colors and the darker blues for accents.

Pine paneling was a very popular wall covering during the Georgian period and while early in the period the colors for these panels were restricted to "drab" or neutral colors, later on the panels can often be seen painted sky blue, pea green or blossom (a pink tone) (Fehrman & Fehrman, 2000). Also in vogue during this period were leathers which were newly available in a wide variety of brilliant hues including blue (Birren, 1963).

From 1760 to 1843, a textile company located in Jouy-en-Jasas in the Bievre valley in France produced a cotton print fabric which became so closely associated with that particular company

that all printed cotton fabrics of that nature are now referred to as Toile de Jouy (Riffel & Rouart, 2003).

Figure 8.1
Robert Adam. The Ante-Room at Syon House in Middlesex, 1762. From *The English Interior 1500 to 1900* by Ralph Dutton, copyright 1948.

Although they produced many different patterns, the ones with which they are most closely associated are the pastoral scenes printed in a single color. The three most popular colors of the single color prints were red, black and blue. The simplest and most popular prints were done in china blue and were known as “mignonettes” (see fig 8.3). Blue was such an important color that a separate building known as “the blue vat house” was devoted solely to the housing and production of the blue print cloths.

The coloration of the fabrics at the factory in Jouy-en-Jasas was done using two methods, applied colors or colors achieved by soaking a fabric in a bath of dye. Indigo and Woad could be used with either method (Riffel & Rouart, 2003). The ban on imported Indigo had been lifted in 1737 and it was greatly preferred over Woad, as Indigo produced a dye which was thirty times

more concentrated than Woad. When the fabric was first removed from the vats it was a green color, however, exposure to air turned the dye its signature blue color.

Figure 8.2
Wedgwood Cream Jug, Jasperware. MFA Boston. From The MFA (n.d.). Retrieved September 28, 2004 from mfa.org/collections.

19th Century America & Europe

In 1850, When Owen Jones decorated the interior of the Crystal Palace for the Great Exhibition in Hyde Park, London he chose to emulate ancient Greek color schemes (Ball, 2001). The Victorians had just discovered that the white ghosts that existed in the form of ancient Greek stone architecture had actually been polychromatic when they were in use. Therefore, Jones

Figure 8.3
Single color Toile-du-Jouy in blue.

decided to use the primaries red, blue and yellow for decorations. However, the interior paints that were available to him at the time were limited to paler, more watered-down versions of the bright primary colors he was looking for and so the end result was not exactly as he had planned it due to lack of availability of appropriate materials.

With advances in technology come changes in decoration (Birren, 1963). This connection can most clearly be seen in the coloring used in interior design after the invention of aniline dyes in the late 19th century. Aside from the more famous "mauve decade," in which mauve's usage rose to a frenzied pitch, aniline magentas, fuchsias and blues begin to be used in interior spaces on upholstery and fabric for wall coverings during the late Victorian period. As a result, the Victorian palette is much more dark and pronounced than previous period styles.

William Morris and John Ruskin founded a decorative movement now known to us as The Arts and Crafts movement in revolt against the falsity and decadence of Victorian design (Birren, 1963). Part of their complaint was against the use of bold, unnatural colors and Morris would advocate instead the usage of a more subdued group of tertiary colors such as blue-green.

20th Century Europe & America

During the 1920's in what would become known as the "Roaring 20's" the leading colors in fabric and carpeting were Burgundy, Dusty Rose and Royal blue (Birren, 1963). It was also during this time period that color in commercial design ceased to be associated solely with aesthetic decisions. Designers began to choose color schemes based on what were believed to be the psychological implications of the applications of each color. For example, blue might be chosen for a bedroom based on the idea that the psychological properties of that color are calm and restful, while red was believed to enhance the appetite and became a highly chosen color for restaurant decoration.

During the 1940's the American Standards Association worked with Faber Birren to develop a safety code of colors which was then adopted by the National Safety Council in 1944 and is now internationally recognized. In this code certain colors were adopted to convey certain hazard warnings. Under this system, "Caution Blue" as it is called is used to indicate any equipment which is out of service or cut down for repair.

Contemporary Design

Feng Shui, the ancient Chinese art of design, which has become increasingly popular in the 20th and 21st centuries in western design offers very strong advice against using too much of the color blue because of its association with the element water. In the online Feng Shui journal

World of Feng Shui, water is described as the most destructive element of all and designers are warned, therefore to, "Avoid painting the ceiling blue or black as it looks like water overhead. Water features should never be placed inside bedrooms. Do not use too much of blue colored upholstery in bedrooms of married couples" (Taneja & Arora, n.d.).

Blue has become the color of masculinity in babies' and men's rooms alike (Mahnke, 1996). Birren (1963) reinforced the connection between blue and masculinity when he suggests in his book *Color for Interiors: Historical and Modern,* that in an institutional setting while pink should be used in girl's bathrooms, teal blue was more appropriate for boy's bathrooms. He further lists a variety of blue colors which he believed were the most appropriate colors for men's retail stores, demonstrating the link in the popular mind between blue and masculinity.

Blue and White China

High quality Persian Cobalt blue (see fig 8.4) was introduced to the Chinese by Kublai Kahn (Esten, 1987). This blue had been used for centuries in Persian ceramics in the form of Smalt. It was soon adopted and by the Yuan dynasty (1279 – 1368) potters in Jugdezhen (an important pottery center) were painting miniatures on unfired clay vessels with this pigment. This Persian blue was known as Mohammedan blue while the finest
quality of the blue pigment was often also known as Buddha's-head blue. The earliest examples are inscribed with the date 1351.

Figure 8.4
Chinese Dish, Late 15th century. Mr. & Mrs. John D. Rockefeller Collection. From J. Esten (1987).

While the Chinese blue and white ware became highly popular in the Middle East, it was seen in China as a vulgar departure from the monochrome glazes used during the Sung dynasty (960 – 1279) (Esten, 1987). Margaret Medley, author of "Chinese Ceramics and Islamic Design" posits that the invention of blue and white chinaware was "the most revolutionary

technical and decorative innovation of the Mongol regime in China, if not in the whole of Chinese ceramic history (as cited by Esten, 1987 p13)."

The blue paint was applied directly on the body of the vessels before being dipped in a glaze and fired (Esten, 1987). The pigment, which looked black/gray before firing, turns an intense blue after firing. Cobalt blue and Copper red are the only glazes, which can withstand such high temperature firing. Of the two pigments, Cobalt blue is the more stable and therefore is seen much more frequently. Many times expensive imported Cobalt blue was mixed with a local, less refined pigment which could cause the final color to be anywhere from light silver to dark blue depending on the proportion of Cobalt used.

During the reign of J'ajung (1522 – 1566) the purification process for Cobalt had become highly refined to achieve a brilliant purplish-blue (Esten, 1987). It was during this time that the West first became acquainted with Chinese blue and white porcelain. However, the blue and white ware produced during the Kangzi period (1662 – 1722) was the most highly prized period of production until early Ming specimens were rediscovered in the 1940's, the blue during this period was a pure sapphire color.

By the year 1552, the Portuguese were importing forty to sixty thousand pieces of blue and white ware a year and yet were still unable to keep up with the consumers demand for the product (Esten, 1987). Henry IV of France and James I of England bought great quantities of the blue and white ware stolen from Portuguese ships by the Dutch who were also great importers of the porcelain. Wealthy Dutch citizens began replacing their heavier stoneware table settings with the newer more fashionable blue and white porcelain.

Dutch potters were nearly driven out of business by the popularity of blue and white ware from China (Esten, 1987). They turned their talents instead to the production of stone and ceramic wall tiles in blue underglaze. Domestic tableware production did not begin again until the Dutch East India Company stopped trade with China in 1644. They also began the production of a faience, which resembled Chinese porcelain at factories in Delft. They produced this ware using an inferior locally produced blue pigment that retained its brilliance because of a low temperature firing process that had been developed. William and Mary were great collectors of Delftware and introduced it to England during their rule.

Blue and white china was popular across all of Europe from the 17th to the 20th century, and those who could afford it spent extraordinary amounts of money acquiring it or imitating it (Esten, 1987). The Trianon de Porcelain built at Versailles for Louis XIV was faced with faience

tiles in imitation of the blue and white ware. Louis XIV gave much thought to domestic porcelain production, but it was not until Louis XV that the porcelain works at Sevres were royally blessed. Porcelain plaques produced at Sevres were often inset in furniture introducing blue accents into French furniture.

King Augustus of Germany was so devoted to the collection of blue and white ware that he traded a dragoon regiment in order to acquire 48 blue and white vases (Esten, 1987). Every one of his castles had a porcelain room to display his vast collection and the push to domestically produce blue and white ware eventually led to the opening of the Meissen Porcelainworks.

Eighteenth century England would, however, dominate the Chinese/Western porcelain trade (Esten, 1987). The number one import from China was tea, but tea requires tea cups. England remains enthralled by blue and white ware long after the rest of Europe and moved on to the new fad: multi-colored porcelain ware. The craze for the collection of blue and white porcelainware from China became "the new interior decoration. Rooms became mere backdrops for displays of blue and white china (Fischell as cited by Esten, 1987 p. 2)." Drinking tea out of blue and white china cups becomes a symbol of typical English life.

In 1800 paste ingredients and bone ash were combined to produce bone china, which was painted with blue underglaze and made blue and white ware more widely available (Esten, 1987). The most famous of the English producers of this blue and white bone ash was Josiah Spode II. Spodeware, as it is known is still highly collectible (see fig. 8.5). This fad reached its height at

Figure 8.5
Spodeware. Plate with Indian Sporting Scene, 1815. Victoria & Albert Museum. From V & A (n.d.). Retrieved September 29, 2004 from vam.ac.uk/collections/ceramics

the turn of the 20th century; the collection mania is well demonstrated in the history of the creation of what is now called, “The Peacock Room,” which Whistler named *Harmony in Blue & Gold* (see fig. 8.6) for Fredrick Leyland which now resides in the Freer Gallery of Art in Washington D.C. (Esten, 1987). Fredrick Leyland was an English shipping magnate who amassed a significant collection of blue and white china, which he displayed in his dining room. He hired Thomas Jeckyll and James McNeil Whistler to create the appropriate backdrop for his collection. Whistler painted a piece known as “The Princess of Porcelain” and then determined that the redone décor of the room did not compliment his painting (Merrill, 1998). He set about trimming the border off of an expensive oriental rug that clashed with his design scheme and repainting all of the walls, which had been covered in hand tooled leather in turquoise blue with gold leaf peacocks which had been covered in hand tooled leather in turquoise blue with gold leaf peacocks. When Leyland returned he was outraged and paid Whistler less than Whistler believed he was owed, leading to a court case and a scandal which was discussed in high society for many months[33] and eventually led to Whistler’s bankruptcy and a decline in health from which he never recovered.

Historical Restoration and Preservation

Farrow & Ball is a British company which has built a business around creating historical paint colors for sale as house paints (Finlay, 2003). They have a spectrometer for measuring color and so even the smallest samples can be matched. However, some historical pigments are no longer legal to produce because of a new awareness of their dangers, such as lead white, while others are simply too unstable for production, such as Prussian blue.

Another problem with paint matching in restoration projects or in historical design is that it is not always feasible to match colors for paint to colors of other media such as ceramics or fabrics (Bristow, 1996). Each media has its own technology and while some types of decorative paints can be transferred from one media to another, others are wholly unsuitable for transference. Therefore, the temptation to match blue house paint with a blue that was used in other historical media such as fabric must be resisted as they are not necessarily historically accurate.

Matching paints from paint names alone can be almost impossible as the paint name did not normally signify a specific formula for mixing, but rather an area in which the paint mixer

[33] It is rumored that upon seeing the room, the interior architect Thomas Jeckyll said only, “Whistler,” and then never spoke again, spending the rest of his life in an institution for the insane (Merrill, 1998).

Figure 8.6
James McNeil Whistler. *The Peacock Room: Harmony in Blue and Gold,* 1877 – 1876. The Free Gallery of Art, Washington, D.C.

should work (Bristow, 1996). For example, one "recipe" for French Grey calls for lead white mixed with Prussian blue "until the desired effect is achieved" and then as much red "as will bestow upon it a faint bloom" (as cited in Bristow, 1996 p. 87). Paints were often mixed on site and then adjusted to the settings in which they were used. A French Grey paint to be used as a background for red linen, for example, might need more red than does one mixed for use against blue linen. This discretionary range created a wide variety of tones and shades to which the same name could apply.

It is also important to keep in mind that just because a paint color was available, does not mean that it could be used in all parts of an interior. For example, the strewing technique of Smalt application made it impractical for use in wainscoting, and water based colors are more often found on plaster rather than joinery elements because of the interaction between the applied paint and the receiving media.

Conclusion

The history of the color blue is a social history rather than a history of purely technical advancement in pigment production (Pastoureau, 2001). Therefore, my research in this area addressed the broad history of the color and its development in terms of social implications such as: language, symbolism and historical usage. In addition, blue is such a difficult color to produce and occurs so rarely in nature that humanity's never ending quest to create and control blue invited a study of its physical manifestations including pigment, dye and paint.

Instilling a base of knowledge regarding the use of the color blue is a necessary component of Interior Design programs. Understanding the historical symbolism and usage of blue is an important part of choosing a color scheme and in the appropriate application of the color. Without this knowledge, a designer may inadvertently communicate something contrary to their intended message.

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BIOGRAPHICAL SCKETCH

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