12-1-2010

Investigation into the use of color as a device to convey memes during the Little Ice Age

Peter Allen White
University of Northern Colorado

UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

AN INVESTIGATION INTO THE USE OF COLOR AS A DEVICE TO CONVEY MEMES DURING THE LITTLE ICE AGE

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts

Peter A. White

College of Performing and Visual Arts
School of Art & Design
Art & Design

December, 2010

This Thesis by: Peter A. White

Entitled: *An Investigation Into the Use of Color As a Device to Convey Memes During The Little Ice Age*

has been approved as meeting the requirements for the Degree of Master of Arts in College of Performing and Visual Arts in School of Art & Design, Art & Design

Accepted by the Thesis Committee:

_____
Michael Coronel, M.A., Chair

_____
Thomas Stephens, M.F.A., Committee Member

Accepted by the Graduate School

_____
Robbyn R. Wacker, Ph.D.
Assistant Vice President of Research
Dean of the Graduate School & International Admissions

ABSTRACT

White, Peter A. *An Investigation Into the Use of Color As a Device to Convey Memes During The Little Ice Age.* Unpublished Master of Arts thesis, University of Northern Colorado, 2010.

Color is used as a tool in visual communication to express ideas in a symbolic fashion. It can also be used as a guide to assist the viewer in the visual narrative. Artwork created in the period of time between 1300 to 1850 in northern and central Europe provides a comprehensive perspective in the use of color as symbol and color as an elucidative devise. This period of time is known as the Little Ice Age, the duration of which spans European history between the Medieval period and the Romantic era. The extreme climatic conditions of this era caused profound changes in society on many levels and influenced the use of color in paintings throughout this chapter in history. The new paradigm of the science of ideas, called memetics, provides a framework to analyze the expression of ideas through the use of color within this span of time.

For Susie

TABLE OF CONTENTS

LIST OF FIGURES

Figure

Figure

CHAPTER I

THE COLOR OF ANTIQUITY

In 2003, the Glyptothek Museum in Munich displayed plaster caste copies of Greek statues in its collection in conjunction with the original sculptures (Gurewitsch, 2008). The austere beauty of a selection of the Glyptothek collection were contrasted against the copies that were, by contrast, painted in highly saturated primary and secondary colors. This was not a promotional stunt by the museum to garner attention, but a serious intellectual comparison between the originals in their present condition and copies, which represented their appearance in a pristine state. Over the last 25 years, the German archeologist Vinzenz Brinkmann compiled archaeological and chemical evidence to support the proposition that ancient Greek and Roman statuary were elaborately decorated with many colors over their entire surface. His painted replicas at the Glyptothek Museum were a demonstration of their original appearance as Brinkmann's research revealed (Gurewitsch, 2008). Marble sculpture from classical antiquity were thought to have been correctly interpreted as an idealized representation of its subject. The translucence and untreated state of the marble was thought to be an aesthetic choice, evoking the unadorned nature of the ideal, and not intended as a representational likeness. Brinkmann's work has invalidated this long-held axiom. Artifacts have consistently contained trace amounts of color, and the

evidence corroborating painted marble Greek and Roman statues has been self-evident before Brinkmann published his results, but his public confrontation of this long-held conviction erodes the established orthodoxy. The 18th century archaeologist and art historian Johann Joachim Winkelmann (as cited in Gurewitsch, 2008) captured the orthodox view, which carries through to the present, when he said,

> The whiter the body is, the more beautiful it is as well . . . color contributes to beauty, but it is not beauty. Color should have a minor part in the consideration of beauty, because it is not [color] but structure that constitutes its essence. (p. 68)

Plato, perhaps the greatest individual influence on the history of Western civilization, had little regard for art of any medium. As David Hoekema (1991) writes,

> Art corrupts, said Plato, by arousing intemperate and inappropriate emotions, and the work of the most skillful artists is the most affecting and thus the most dangerous. In this way art undermines social order and plants the seeds of disobedience. In a well-governed state, Plato proposed, our artists will create plays, poems, and songs that stir patriotic and loyal feelings. They will understand that it is not for them to determine what is truly good or socially useful, for that is the task of the rulers, who must be selected for their wisdom. Any work of art or kind of artistic activity that fails the rulers' test of social usefulness-even the greater portion of Homer, the bible of Greek culture-will be strictly forbidden. (p. 45)

The reverence placed on the words of Plato in the collective consciousness of the West have shaped the view in classical scholarship and throughout the culture at large that Greek and Roman statuary are devoid of color. Brinkmann's findings call for the reexamination and revision of the overall prevailing assumptions and views in the study of ancient Western art and philology.

No single element in art drives emotion more effectively than color. The Greeks knew this and deliberately painted their marble works for the purpose of

eliciting a reaction in the viewer. Winkelmann's perspective of natural marble as an aesthetic ideal mirrors Plato's sensibilities, but does not reflect the reality that ancient sculpture was painted in what might be characterized in contemporary terms as garishly colorful. The true nature of ancient sculpture seems to be more relevant as a form of unceremonious diversion than a stoic and formal object of grandeur. It appears that a public space in ancient cities adorned with statues had a more festive and light ambiance than the solemn magnificence in which those gathering places of the past are prescribed from a modern perspective.

The contradiction between fact and perception regarding Greek and Roman statues draws attention to the dynamics of how ideas are formed and how they are sustained or change over time. Despite evidence to the contrary, the modern understanding of the Greek aesthetic is one of austerity, representing the ideal and intellectual nature of the subject. This point of view is our cultural idea of Greek sculpture, and it is our concept of our visualized Platonism that provides the context for the contemporary mind to relate to antiquity. It is the modern intellectual edifice of what Greek sculpture is supposed to be, which instructs our expectations of the subject. The newly discovered facts regarding Greek sculpture do not penetrate this framework, which has been deeply planted in the cultural consciousness. The incongruity in the case of Greek statuary between cognitive presumption and actuality defines a universal dynamic associated with any manifestation in the conscious mind; it clearly defines two independent states of a mental construct, what is real and viewed, regardless of whether the reality is aligned with it or not. This perceived state originates from other

information not necessarily discovered by the viewer directly, but absorbed from a myriad of cultural sources and reinforced by yet more indirect sources.

The unblemished marble of *The Laoicoön Group* (circa 100 BCE), the Parthenon (447 BCE), Michaelangelo's *David* (AD 1504), and Antonio Canova's *Napoleon as Mars the Pacifier* (AD 1806) are consistent with Plato's comments regarding art. Ideas originating from Plato have reinforced other ideas to form an expectation of what Western sculpture and architecture are supposed to be. Austerity is the contemporary notion of Greek aesthetics. The sudden introduction of facts, which thoroughly refute this idea, has not in any way diminished the view of the proper appearance of classical Western sculpture. This idea has successfully survived over 500 years, and it will doubtless remain for the foreseeable future.

CHAPTER II

MEMES

A recent approach to understanding the success or the failure of mental constructs and how they develop and change through time uses evolutionary biology as a framework to isolate, identify, and track the dynamics of an idea. This new science, called memetics, provides a unit of measurement for a mental element. It is called the meme. This is a methodology and a paradigm originated in 1977 by Richard Dawkins, an ethologist at Oxford University. It was first published in his book, *The Selfish Gene,* and is a replacement for the concept of the idea.

> Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches . . . memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. (Dawkins, 1977, p. 206)

The advantage of reformatting ideas as memes lies in their greater quantifiability. Consequently, an idea can be studied as if it were an organism, and multiple ideas can be viewed more as populations rather than cognitive processes. This can add a far greater understanding to their origins, and it can lead to a more accurate view of their survivability and their effect on other ideas.

Richard Brodie (1996) describes a meme as, ”anything that gets imitated . . . [a meme] is the basic unit of imitation.” He adds the further point that, ”all of our labels

for things are any other element which is identified as distinct from something else" (pp. 3-14). Instead of looking at an idea as a static phenomenon, a meme is characterized in a dynamic fashion, and its success of failure over time will be based on conditions similar to the study of an organism. The three properties of survivability are:

1. Longevity. The first feature of a meme is longevity. The archetype of a Greek statue—austere, formal, and lacking color—Greek statues have been around for centuries. This stable and widely held entrenched notion within a wide section of the population means that it is more likely to survive intact than the idea of 18th century men's stockings.
2. Fecundity. Fecundity, or reproductive productivity, will determine whether an idea becomes seeded in a population or lingers in niche regions. The Internet phenomenon of a video *going viral* is an example of successful fecundity for a meme.
3. Fidelity. If one person tells a story to another, then the second tells it to a third, and a third to a fourth, the final version of the story is likely to be very dissimilar to the original telling. This is poor copying fidelity. The integrity of the meme has degraded over a series of replications (Dawkins, 1977, p. 24).

Richard Brodie (1996) also defines a meme as a basic unit of information in a mind, which in turn influences events such that more copies of the meme are created in other minds and identifies stages a meme must go through to achieve a point of

acceptance in a group. Once accepted, the memes' sustainability is determined by survivability, but it must pass through these stages first:

1. Complacency/marginalization.
2. Ridicule.
3. Criticism.
4. Acceptance.

The meme operates as a parasite does in the biological world. The existence of a meme is not related to any effect it may have on the host mind. A devoutly religious flagellate does not benefit, in any secular way, from repeatedly whipping himself. Nonetheless this behavior has persisted from the Middle Ages to the present. The meme can be successful, even if it kills its host, as long as it can replicate before the individual dies.

According to Brodie (1996), memes fall into three categories: distinction, strategy, and association. The distinction meme does what the name implies, it distinguishes one thing from another. The flags of Russia and France are both used to represent each respective country; they both use the same colors and are both rectangular in shape. The Russian flag has horizontal bars and they are organized horizontally as white, blue, and red from top to bottom. The French flag has three vertical bars with blue, white, and red running from left to right. The only element which distinguishes the flags of these two separate countries is the position of the three colors. These two objects can be identified as representing two separate mental constructs,

differing only by the spatial organization of the colors. The Russian flag and the French flag are two separate memes.

Strategy memes are beliefs in cause and effect. If a certain behavior is initiated, then there is an expectation regarding the outcome of the result. Generally this is a learned behavior. If an electronic stovetop glows red, a strategy meme would provide a behavioral instruction for a successful outcome. An association meme would be indicating red stovetop equals very hot, and the strategy meme would provide direction to avoid the surface. The distinction meme defines the conditions, and the strategy meme provides the appropriate behavior for those conditions. Color, then, provides for a differentiation and it triggers a behavioral outcome.

The combination of the red stovetop distinction meme and the avoidance strategy meme into one amalgamation is an example of an association meme. This is also the technique used by advertising as an effective means to attract individuals to purchase goods and services. The use of specific type faces in advertising or logos is one example. A serif type face (see Appendix, Figure 1) originated in Roman times and was based on the shape of roots of a tree that forms into a trunk. This design suggests strength, endurance, dignity, stability, and growth. A san serif type face (see Appendix, Figure 1) represents transience, cutting-edge, hi-tech, and egalitarianism. Both of these type faces have their own distinction memes, based on their shapes, which provide a clear distinction between the two. Marketers of banks and other financial institutions will tend to use a serif type for a logo, so that they can take advantage of the memes associated with them and distinguish and separate the

business from the memes associated with san serif type. The connection of the established memes of a serif font with a business will tend to elicit a behavioral response from a consumer. The buying decision will favor a bank associated with strength, endurance, dignity, stability, and growth over transience and egalitarianism. The New York Stock Exchange is designed to look like an ancient Roman building, with the appearance of cut marble, using a serif type face. Unlike the facts Brinkmann has discovered, it is highly unlikely that the New York Stock Exchange, or the sculpture of the bull and the bear, will be painted in bright, primary and secondary colors in the foreseeable future. It would invite the stages of marginalization, ridicule, and criticism before such a a change is accepted, and that would not be good for business.

Like biological species, memes cannot inhabit the same cognitive terrain. As an example, one individual cannot accept both of the memes of Protestantism and Roman Catholicism to be true at the same time. There are many examples of individuals and families in the Reformation professing one religion and secretly practicing the other. The memes for the practiced religion would survive through the children. One meme will survive at the expense of the other in the individual. In the example of Greek sculpture, either the notion of colorful statues will eventually prevail or the dominant formal view will endure. In this case, separate niches might allow for the survival of both. The memes for a colorful classical sculpture might remain within the academic sphere when it is eventually accepted, but the meme of unadorned marble statues would certainly live in the larger population for a considerable time.

The reason why ancient Western sculptures were colored may never be known, nor why the specific colors were used. The colors chosen could be associated with a particular god or gods, or they could be associated with military or societal groups such as in the case of warrior statues, or it could be simply to induce a bright and festive ambiance in the area they were placed. It may remain a mystery, but it is certain that the colors were chosen to represent and promote one or more memes.

A critical feature of the meme regarding its survivability is separate existence from the mind in which it is contained. Like a virus or a parasite, a meme may or may not be beneficial to its host. It may even be destructive or lethal to the individual. As Richard Dawkins (1977) states, "a cultural trait may have evolved in the way it has, simply because it is advantageous to itself" (p. 215). From the point of view of the meme, the only issue concerning the welfare of the host is whether or not it can effectively replicate itself before the host dies. If a martyr kills himself because of a meme, which engenders some wish fulfillment or that it is the will of God, then ultimately this meme has not been beneficial for the individual. As long as the meme reproduces itself in another individual before this act, it will survive while the host will not. This is the case for modern day suicide bombers. The individual's death will instill and promote more of the same behavior with many others and the meme continues. The individual's death instills and promotes more of the same behavior with many others and the meme continues.

The totality of memes in the human species is called the nooshpere. Teilhard DeChardin (as cited in King, 1998), a Jesuit priest and paleontologist interested in

cyberspace and the spiritual, defined the nooshpere as, “a growing layer of ideas around the planet, physically embodied in the conscious brains of humans” (p. 26). Daniel Dennett (as cited in Dawkins, 1998), a cognitive scientist and philosopher, defines human consciousness as, “a huge complex of memes” (p. 306). The Internet is the current and most effective integrated form of the nooshpere, although this concept is not exclusive to the digital age. When something *goes viral* on the Internet, it is a meme successfully replicating itself over a large population and at near instantaneous speeds. The ecosystem of ideas is evolving at a rate the human mind cannot grasp, and yet the vast majority of the human species is impacted by this dynamic upheaval. The noosphere has existed as long as the human species, but it presently takes shape and is shaped by the virtual world. In the digital environment, the integration and recombination of memes are without geographic limitations or cultural barriers.

With the vast mesh of information presently available, the longevity of a meme becomes problematic, but for short periods a meme can be replicated faster and in a larger population than in any other medium in history. Memes will now constantly evolve from the unprecedented volume and integration of ideas pervading the digital world. Color will play a significant role in this dynamic, either reinforcing currently integrated memes or causing the evolution of memes already in the noosphere. As Foss (1971) describes of art, “symbols are deployed in unprecedented ways to say new things or to say old things with new perspicacity” (p. 240). Avoiding the requirements of cognizant processing that language requires, color as symbol can be a much more immediate and effective means to deliver and sustain a meme. In the brave new world

of the digital noosphere, in identification of memes through the use of color will further increase the speed at which meaning changes.

In the current Western, digitally-driven culture, little is static. There is a constant barrage of audio-visual imagery to persuade the viewer to purchase things, vote for a particular candidate, or perceive the world in a certain way. In Neil Gabler's book , *Life: The Movie: How Entertainment Conquered Reality* (as cited in Hedges, 2009), he describes current Western society as a celebrity culture:

> It is not a convergence of consumer culture and religion, but rather a hostile takeover of religion by consumer culture. Commodities and celebrity culture define what it means to belong, how we recognize our place in society, and how we conduct our lives. (p. 16)

Instead of Gothic cathedrals and artistic masterpieces as a principle visual communication, there are all manner of electronic forms of visual entertainment, which have life cycles measured in days or weeks and not centuries. The forms and colors of past artworks will have less in symmetry with modern society as the distance of time becomes greater, but the use of the fundamental colors may remain. Whether it is the Greek statue of a god, a Roman emperor, the Christ, or spiritual forces, red, blue, yellow, and green have consistently represented those things in society that influence, guide, and dominate our lives. It should be no revelation that it also represents a fundamental element in the tapestry of the digital noosphere—the Google logo.

CHAPTER III

ART AND MEMES

Art is the premiere form of non-linguistic visual communication, and it is an effective conveyor of memes. Line, shape, value, hue, and texture mix together to form associative memes, which potentially replicate themselves to the viewer. Each element of composition can have its own memes, separate from the whole, without regard to whether the artist made deliberate choices. Multitudinous memes emanate from each canvas and fresco.

The postimpressionist George Seurat invented Pointillism in 1886, inspired by a paper written by James Whistler regarding artificial light and infusing the psychological and physiological memes of the time (Ataly, 2004). His work has been the subject of much analysis regarding his use of the golden ratio as the basis of the composition. According to Ataly (2004) in *Math and the Mona Lisa*, the definite existence of phi in works like *The Parade* were not deliberate and intentional, but intuitively or unconsciously expressed. In 1963, Charles Bouleau (as cited in Livio, 2003) said, "I do not think we can, without straining the evidence to regard [Puvis de Chavannes's] composition as based on the Golden Ratio. The same applies to Seurat" (p. 167). If Bouleau is correct, then Seurat's work is an example of the meme associated with the

golden ratio expressing itself through individuals without any deliberateness on the part of the artist. Over centuries, the golden ratio meme has effectively replicated itself, not exclusively through artists with a specific intent, but through the actions of some artists with no conscious awareness of expressing this meme and passing it through time by means of their work.

Laurence Foss (1971) regards art as to be judged by how well it enhances our sensibilities and our understanding.

> Symbolization, then, whether linguistic as in natural languages, science and literature, or nonlinguistic as in the fine arts, is, on the present showing, to be judged by how well it enhances our sensibilities and, finally, our understanding: Does it cause new connections to be made within our nervous system? (p. 242)

Essentially this is saying that the effectiveness of a work of art is in its ability to convey memes to new minds. If art resonates with the viewer, it is effectively passing on ideas. The fidelity of the transfer and how well it takes root is dependent on the skill and choices of the artist and whatever memes the viewer has to associate them. One of the greatest tools the artist has for this purpose is color. As Otto Rank (1932/1989) said,

> We have revealed to us one of the deepest laws of all artistic productivity: the fact that in works of art, form and content not only constitute an inseparable unity, but actually express one and the same thing on two different ways. (p. 69)

The understanding of a shape or a color, or a combination of a shape and a color will emit a unit of meaning—a meme—in the viewer. As a brightly colored statue from antiquity carried meaning for its contemporary viewers, potentially all art can convey memes relevant to other memes of its age.

The context of a subject or an object plays an essential role in relaying the appropriate memes, or in making new association memes with existing memes. In 1971, William G. Lycan investigated this problem in his essay, "Gombrich, Wittgenstein, and the Duck-Rabbit," where he refers to what is seen in a painting by a viewer through E. H. Gombrich's construct of *seeing as*. This hypothesis contends that a given object in a painting is interpreted correctly only in relation to other elements. In regard to this context, Lycan (1971) refers to E. H. Gombrich's art and Illusion:

> A painting is not a faithful record of a visual experience but the faithful construction of a relational model; and such a model can be constructed to any required degree of accuracy. What is required of a representation depends upon "its purpose" and the society in which the given visual language gains currency. (p. 230)

Lycan also deals specifically with the phenomenon of color within the larger construct of *seeing as*. He sees color, not as having meaning as an innate phenomenon, but also needing a conceptual reference, which is a fundamental feature of learning. "Training in color-concept-acquisition is probably the most basic [training] we receive, and that the subsequent use of color-words is very uniform" (Lycan, 1971, p. 236).

The purpose of a colorfully painted Greek sculpture over 2,000 years old cannot be entirely made clear from our current perspective. The memes organized around the colors used in Greek and Roman statues, which were common knowledge at the time of their creation, may not be possible to ascertain in the present day. Clues can provide guidance from philology and archaeology and could possibly illuminate more precisely the artist's intent of the context of the colors on an object and what it

meant in their time. The trap modern investigators have in this endeavor is the context of color in the present time, and to remove that from any assessment relating to these works of antiquity.

Gustav Mahler (as cited in Gleick, 1988) captured the pitfalls of attempting to interpret the past from the perspective of the present when he said, "like the motions of dancing figures in a brilliantly lit ballroom into which you look from the dark right outside and from such a distance that the music is inaudible . . . life may appear senseless to you" (p. 163). The 21st century viewer cannot know why an artist specifically chose one color and not another in any given circumstance, unless if there is some kind of written record that makes it clear from the period of its creation, or unless what is perceived about color at the time of the artistic work is also known in the present. A given color may associate itself with a specific condition 2,500 years ago, but the same bandwidth of color in the present may be connected to another condition. If the condition of 2.5 millennia ago is presently unknown or it has evolved as to be unrecognizable to the modern viewer, then the initial meaning has been lost.

Memes, like organisms, evolve over time. The greater the scale of time, the greater the change. Laurence Foss (1971) adds to the comments of Nelson Goodman when he says, "Goodman cautions us against . . . an all too human tendency to omit specifying a frame of reference when it is our own" (p. 237). If Gombrich's faithful construction of a relational model is true, then the viewer can receive memes from art across a great expanse of time through its design elements and in particular through its

color. The fidelity of the original mental construct is dependent on the accuracy of the reconstruction within the artwork.

Color may have the capacity to retain the fidelity of memes that have a more general or fundamental meaning. An example of this type of meme fidelity can be seen in Kasimir Malivech's *Taking in the Rye* (see Appendix, Figure 2), Cimabue's *Madonna of the Holy Trinity* (see Appendix, Figure 3), and the colored Greek statues duplicated by Brinkmann. All of these artworks, and all from different times, use the same palette: red, blue, yellow, and green. While it is presently not known what the exact nature of color on Greek statues represents, it could be reasonably supposed that color was to enhance a god-like nature or to induce an iconic feeling of the subject. If this is accurate, then it is in keeping with the God-Christ motif seen in icons from the Middle Ages and Malivech's modern era depiction of the peasant as archetype. Since pre-Renaissance icons used this palette, this may be an example of color having a quintessence, which reaches across time and culture. Gombrich's relational model could be applied to the color group of red, blue, green, and yellow and not just to objects within a painting. This could illuminate the existence of deep seated memes, which retain their integrity regardless of their point in history.

The specificity of the subject matter within these three paintings is entirely different, but the general use of these colors would all be consistent with the delivery of the subject as an idealized representation using color to achieve that end. Kandinsky's, *Fragment II from Composition VII* (see Appendix, Figure 4) uses the same palette, however his condition of synesthesia complicates the issue of meme

identification. Unless the viewer hears sounds as he did, the intent of the meaning can never really be known. However, Kandinsky's interest in thought forms and theosophy may place his use of color in the category of the above three examples.

Different schools of color theory will espouse red, blue, and green as the primary colors and others of red, blue, and yellow. In either case, all four colors, red, blue, yellow, and green, are elemental to the delineation of color in the human condition. Each one will have its own memes associated with it at different times in history, but as a group they seem to correspond to fundamental ingredients of the human experience of color, and their use in combination would seem to indicate the attempt to convey an elemental message.

CHAPTER IV

COLOR

The phenomenon of color has biological dimensions, which cause preconscious reactions. There are developmental and environmental factors that affect the processing of color in the brain. The reaction to a color is not only based on whatever memes are operating in that brain, but also by the nature of the lighting conditions and the condition of the optic receptors and pathways.

The human eye can see between approximately 400 and 700 nanometers. A nanometer is one billionth of a meter. Wavelengths larger than 700 nanometers, or infra-red light to radio waves, do not reach the cells in the retina of a human eye. They are absorbed by the cornea, the lens, etc., and are thus invisible. Light below 400 nanometers, or ultra-violet to gamma rays, can cause cancer in larger doses over time, and thus ultra-violet energy is absorbed before reaching the retina. Animals with short life spans typically can see ultra-violet light, and it is primarily the ultra-violet reflecting off of flowers that attract pollenating organisms (Williamson & Cummins, 1983). These animals do not live long enough to be detrimentally affected by these wavelengths, and thus seeing these wavelengths which carry more energy does not impact the species in a detrimental way.

There are two kinds of photoreceptors, rods and cones, which respond to incoming light. Rods are more sensitive to light and provide value or brightness of an object. They are so sensitive that one photon will cause them to react (Jane Boch, 1985). Cones are the cells that are reactive to different wavelengths, which provide us with the raw data regarding color distinctions, but are not as sensitive as rods. Rods do not respond to color, only whether there is light or not. This is why seeing at night drastically diminishes color or eliminates it entirely from the visual field. Since rods are sensitive to value, they are the source of visual detail and shape in bright conditions or at night.

There are approximately 120 million rods in the eye compared to 6 million cones (Technical Advisory Service for Images Advice, 2004). Rods are found in the outer region of the retina and cones more toward the center. This allows for the greatest detail of information with a direct line of sight, while color information is largely from the peripheral vision. This has interesting effects, which the impressionists were most adept at exploiting (Livingstone, 2004). Monet created the image, *Hotel des Roches Noires, Trouville,* in perspective which, in keeping with the impressionist style, looks unfinished as the viewer perceives it from a direct viewing (see Appendix, Figure 5). However, if the gaze is set on the clouds or off from perpendicular to the picture plane, the imprecise brush strokes and swatches of color develop a clear recognition as flags, buildings, people, and a cloudy sky. The visual system is assigning meaning to the color of adjacent objects. This phenomenon is called illusory conjunction (Jacobs & Nathans, 2009). No detail is required to relate to known

memes as long as the placement of strokes of color are carefully placed. Repetitions of strokes of red, white, and blue become French flags, and vertical blobs of contrasting values become people.

Cones have three types of pigments, and each cell contains one of the three: there is a pigment for short or blues, one for middle or greens, and one for long or red wavelengths. Most mammals have one type of color receptor, which is for longer wavelengths, making the warmer colors available to many animals, but cooler hues will only be interpreted in shades of value or greyscale (Briggs, 2008). The red cones tend to be more sensitive to orange light than to red. This is why yellow and orange appear as brighter colors. It is not that the wavelengths of orange carry more energy than blue light; the opposite is the case, so the human eye recognizes yellow/orange more intensely than higher energy wavelengths such as violet. Our cells are designed to respond more effectively to an orange than a cool color. This has to do with our eyesight evolving such that the eye takes advantage of the most prominent light source, the sun. The human eye responds to the color of solar output, referred to as the spectral power distribution (Williamson & Cummins, 1983). The origin of our distinction in brightest of different colors, then, is the sun.

Trichromacy is the process of using three separate colors to interpret the range of visible light (Briggs, 2008). The colors that the eye responds to are red or long wavelength, green or medium wavelength, and blue or long wavelength. If all three of these are available in the eye, the individual will be capable of seeing the full spectrum available to the human species. The condition of color blindness takes many forms,

but typically results in the absence of one or more of these three pigments. There is a small population of women who have four types of pigments instead of three; this adds the possibility that a few individuals can see a much broader spectrum than the largest group of people. There is no congruous testing that has definitively proven that these individuals are in fact seeing a much wider spectrum than the rest of society, but it is an intriguing possibility. These individuals, potentially seeing considerably more colors than the rest of the population, would be in a comparatively similar relationship as the majority is to color blind individuals.

Recently, it has been discovered that humans have two distinct types of chemical sensors for orange-red light (Jacobs & Nathans, 2009). Approximately 60% of the population respond to a higher wavelength of red light than the other 40% of the population, and these two groups perceive color in a slightly different way. It may also directly address the meme in contemporary society regarding the phenomena of some being more attracted to red objects than others. Not only do humans see warm colors more efficiently than cool ones, but there is a division in the population as a whole on how red is perceived. It is theorized that primates evolved in the trichromatic form of color vision because it increased the vibrance of red fruits and green leaves, and thus made identifying food much easier for those with this capability (Jacobs & Nathans, 2009). Increased nutrition would be a selective advantage for survival. This feature of human sight may also account for the phenomenon of the affects of complimentary colors.

On a traditional painter's color wheel (see Appendix, Figure 6), colors directly in opposition are referred to as compliments of the other. Red is a compliment of green, and blue is a compliment of a yellow-orange. In paintings, when compliments are used in such a way that one colored object is adjacent to another larger field which is its compliment, that object appears to vividly display itself in a far greater measure than if non-complimentary colors are used.

The phenomenon of complimentary color and its physiological effects seems to draw from the combination of the acquisition of value information and color information from separate optic sources. The interpretation of values provides the mental construction of shape. When complimentary colors such as green and red are in relatively equivalent and substantial areas of the visual field and they are adjacent to one another, the value information of the brain will identify these two separate colors as one larger object of the same or similar value. Further processing in the visual cortex refines information to refine edges and orientations of objects (Livingstone, 2004). The color information sees two opposing colors and thus two shapes, and the value information, which is much higher resolution, sees only one. This contradictory information will cause interesting psychological effects, including a shimmering movement of the areas, to headaches in some individuals (Merchen, 1997).

The Greeks used blue in their works but made no literal association with it as distinct from other colors. They had no word for the color blue, and features such as the ocean would be described as green or wine-dark. Theophrastus (371 BC to circa 287 BC), who was appointed the head of the Lyceum after Aristotle's death, associated

blue with shadow. "For where the light fails, there, being penetrated by darkness at this point, it appears blue" (Hoeppe, 2007, p. 30).

William Gladstone, the conservative Peelite in Parliament in the 19th century, published several articles between 1858 and 1877 in which he expressed the idea that the Greeks might be color blind to blue (Gage, 1999). However, it is the oldest synthetic pigment, dating back to BCE 2,500. Alexander the Great conquered Egypt in 332 BC, and Ptolomy I declared himself Pharaoh in 305 BC. The knowledge to produce and the distinction of blue was certainly a part of the Greek cultural knowledge by this point in history. Koch-Brinkmann's work unveiled at the Glyptothek museum in Munich in 2003 has shown chemical evidence of medium, saturated blues in the the statues he has analyzed. These works date from approximately 530 BC to 320 BC (Gurewitsch, 2008). Before the Renaissance, color was used as a means of symbolic expression such as exemplifying the power of natural and supernatural forces and not as an aesthetic or representational element (Gage, 1999). Accordingly, blue for the Greeks might be associated with another color or some other feature of the cultural memes.

Unlike Gladstone's assertion, the Greeks as a population were able to distinguish the color blue, but there has been no trace of written documentation to show that it was considered distinguishable in the color spectrum. Henry Guerlac (1986), an historian of science at Cornell University from 1941 to 1975, reported that Aristotle identified blue, along with white, yellow, red, violet, green, and black as the

distinguishable colors, although black and white were the only fundamental colors from which all others derive.

This disparity between using blue, as is seen in the statues, and not representing it in written documentation regarding sea, sky, etc., could be addressed in the makeup of the memes associated with the color. Chemical evidence of green was found to be another color used on the statues, so it was distinct from other cools by the ancient artists. The answer to this puzzle is not presently known.

A possible answer for the lack of literal articulation of blue in Greek writings and the apparent contradiction of its use on statuary could lie in its association with shadow. In one of his surviving Codices (circa 1508), Leonardo da Vinci (as cited in MacCurdy, 2003) described shadow and blue:

> The shadows of verdure always approximate to blue, and so it is with every shadow of every other thing, and they tend to this colour more entirely when they are farther distant from the eye, and less in proportion as they are nearer. (p. 934)

The shadow of foliage, according to the Leonado da Vinci, is blue. As distance increases, greenery becomes more blue. The blue in shadows at a distance are derived from another physical phenomenon outside of the individual. Light reflected by water in the air, which absorbs all colors in the spectrum except blue, causes objects at greater distances to appear more blue. However, shadows in the immediate domain of the vegetation will produce the perception of a blue tint. "The definition of the blue colour of the atmosphere supplies the reason why landscapes are a deeper shade of blue in summer than in winter" (Leonardo da Vinci, as cited in MacCurdy, 2003, p. 930).

Johann Wolfgang von Goethe (1810) observed, experimented with, and reported the phenomena of colored shadows in his work, *Theory of Colours*.

> Let a short, lighted candle be placed at twilight on a sheet of paper. Between it and the declining daylight let a pencil be placed upright, so that its shadow thrown by the candle may be lighted, but not overcome, by the weak daylight: the shadow will appear of the most beautiful blue . . . no kind of blue light or reflection is necessary to produce the effect in question. The experiment can be made on a cloudy day with white curtains drawn before the light, and in a room where no trace of blue exists, and the blue shadow will be only so much the more beautiful. (pp. 17-18)

Goethe is reporting a real, repeatable experience that identifies color in shadow, and yet at present, no theory in neurology or physiology can expound on the mechanisms which cause this effect. The operations of the trichromatic color process cannot account for it. Goethe theorized in his two-opponent model of color perception that the visual process contrasts information. This theory was formally proposed by Ewald Hering in 1878 (Williamson & Cummins, 1983). In current scientific modeling, neighboring cones are cross referenced to distinguish a specific color (Jacobs & Nathans, 2009). Based on the observations of Goethe and Leonardo da Vinci, it may be that the Greeks saw blue more in terms of shadow, which is referred to in Leonardo's observations, and blue as a manifestation of shadow as Goethe interpreted the phenomena. In the eyes of the Greeks, blue could be a distinction meme, which would be defined as blue equals shadow.

Blue has transitioned over time in European cultures to be associated with several different memes (Varichon, 2006). It was first a color not recognized in ancient Greek literature. Blue then became associated in Rome with the Germanic tribes. Celtic and Germanic barbarians would stain their skin with blue from a tincture

created from dyer's woad, and this would illicit fear and disdain shown to those enemies. In the 12th century, blue became associated with the Virgin Mary and with mourning. After the Middle Ages, blue was the symbol of royalty, nobility, fidelity, and peace. In the 18th century, indigo became such an infatuation in European aristocracy that the term indigomania was coined to describe its high desirability. Today, it generally represents calmness or sadness. This single color has transitioned in the West through the entire gamut of human emotions in the span of recorded history, allowing this one primary color to be the vector for, and to represent many different memes throughout recorded history.

CHAPTER V

THE LITTLE ICE AGE

For most of the last millennium, central and northern Europe were profoundly and negatively impacted by environmental conditions. Plagues, famines, wars, and social upheaval during this period were all catalyzed directly or indirectly by extremes in temperature, precipitation, snow and ice, and wind. This span of time, known as the Little Ice Age, began in the approximate year 1300 and did not relinquish its hold on the continent until 1850 (Fagan, 2002). All areas of the globe saw some impact during this period, but the most dramatically affected and documented regions were on the European continent, north of zones influenced by Mediterranean maritime climate. Glaciers would envelope and destroy whole villages and towns within a period of years.

The term Little Ice Age was originally coined by Matthes in 1939, regarding the regrowth of glaciers in the Sierra Nevada, California (Matthews & Briffa, 2005). Since that time, it has taken on a more encompassing meaning, referring to the overall cold and volatile climatic conditions throughout the globe during the period between 1300 and 1850. Large scale variance in environmental conditions occurred during this period, but science has traditionally viewed change in geological and meteorological terms as, in human terms, an extremely gradual process. Uniformitarianism, or the

idea that earth changes are an unfathomably slow and incremental processes, is a remnant of Victorian scientific thought. In his book, *The Little Ice Age,* Brian Fagan (2002) describes this epoch as, "an irregular seesaw of rapid climatic shifts, driven by complex and still little understood interactions between the atmosphere and the ocean. . . . The Little Ice Age was an endless zigzag of climatic shifts, few lasting more than a quarter century" (p. xiii). Human activities were dramatically affected throughout this entire period. The Black Death of 1348 has been linked to weather conditions that made flee infestations particularly favorable. The Spanish Armada was dealt a catastrophic blow due to the extreme inclement conditions in the English Channel and Atlantic ocean. One-third of Finland's population died in 1696 from famine and disease directly linked to poor growing conditions. Ten percent of the population of France died of the same in 1695 and from the same cause. Napoleon's army starved and froze to death in 1812, and the Irish potato blight occurred as a direct result of wet and cold conditions, which made the potato inclined to fungal infection. These sweeping historical events in the human narrative are all attributable to affects of weather and the environment which, as a whole, constitute the Little Ice Age (Fagan, 2002).

Science uses various methods to determine and extract data so that a coherent picture can be formed of what the general characteristics of the Little Ice Age were like. A composite of different sources exist, which range from historical records to various specialties in the natural sciences. Harvest yields, personal accounts, temperature records, census data, and grain prices are available in varying amounts throughout

the period in the historical record. The natural sciences provide ice core information that contains atmospheric and snowfall amounts, glacial movement and growth, pollen counts, tree ring analysis, ocean and lake sedimentation records, along with astronomical records regarding the activity of the sun. All of these provide varied direct quantitative evidence of the nature of the conditions during this time. When an interdisciplinary framework is used to meld these differing quanta of information into a coherent picture, it is possible to substantiate the conditions of the environment during the periods from the latter Renaissance of the 1400s to the Romantic period ranging from 1790 to 1850. Climate can then be seen as a connecting and contributing element in the evolution of the art of this time frame.

This type of analysis is not intended to be precise in the sense of knowing the temperature and weather conditions at the time any given artwork was created by any given artist. Rather, it is an attempt to gain some insight in a general way concerning the trends over time and through a more general perspective of artistic periods in the central and northern regions of Europe during this period of the Little Ice Age. In order to gain a quantitative and thorough understanding of color usage during this time, a statistically significant group of artworks would need to be studied with the surface areas of color measured for each studied artwork, along with any complimentary colors and their relative positions for each artwork. By amassing this type of data, a clearer understanding of the relationship between climatic conditions and color use could be known, which would carry a level of scientific validity. For this discussion, the question of the affect of the environment and its consequences toward art

production in the Little Ice Age considers a few pieces of art from various times with the intent of linking color choices, climate, and lighting conditions and potentially making the question a credible postulate for more in-depth study.

Artists are the visual narrators, proselytizers, and chroniclers of their times. As the mathematician and philosopher Alfred North Whitehead (as cited in Aldrich, 1965) contends, a work of art is a proposition. It is a concept, idea, theorem, or argument. In 1943 Whitehead (as cited in Price, 2001) said, "art is the imposing of a pattern on experience, and our aesthetic enjoyment in recognition of the pattern" (p. 225). Art is, then, a meme. More precisely, it is a carrier of memes. It carries the influences; portions of the nooshpere of its age; and provides a point of view from the artist, the patron, or the culture regarding the aggregate of active memes of that time. An artist will choose his design elements in such a way as to be able to convey the memes to be expressed in the most effective manner. It is therefore reasonable to conclude that, during the Little Ice Age, artists were as affected by these environmental shifts as the population at large, and this in turn would affect the use of color to express those memes. It would require a certain visual idiom to select colors in an overcast, diffuse light as opposed to a sunny bright setting. If there is a continuity of sunny bright days, or by contrast, of dreary, cold and damp daylight hours, this influence will greatly affect the choices made and the work.

Before 1783 sunlight would have been the best source of illumination for the viewer. After this date, viewing images would have been qualitatively different with the introduction of the Argand lamp (Perkowitz, 1998), which was commonly used in

Europe and particularly in France. The light emanating from this device illuminated the gilded halls of the French aristocracy so intensely that it was said to have contributed to the French Revolution by literally lighting up the disparity between the classes. Sidney Perkowitz (1998), Professor of Physics at Emory University, says of the Argand lamp,

> The Argand lamp was valued for its brilliant light, perhaps in its time as stunning as laser light is now. . . . Just before the French Revolution, bright Argand lamps enhanced the great glitter and draw of the Palais Royale, the center of parisian nightlife. The cheek-by-jowl contact there reflected tensions among social castes. (p. 97)

Before the Argand lamp, in areas lacking extended access to direct sunlight, overcast, diffuse light or candlelight would have been the principle source of lucency. These very different qualities of ambience would undoubtably influence the choices made by the artist, and those choices determine the effectiveness in the delivery of the message. If these statements are accurate, it would be possible to see trends, or groups of paintings from certain times and places, having similar characteristics with regard to color choices.

The year 1546 began a series of periods in which glaciers throughout northern and central Europe and the rest of the world grew at rates not seen before or since (Fagan, 2002). There were six major episodes of glacial expansion from this year until 1850. In order for a glacier to grow and advance in relatively short periods of time, significant precipitation in the form of snow must be added to it. Once the snow has fallen, it needs to remain in order for the glacier to grow. Whatever the warming effects are the following year, and whatever snow evaporates, must be inconsequential

enough as to not diminish any large gains in order for the advance to have occurred. Long periods of heat from direct sunlight and warmer weather in the non-winter months would largely negate the accumulations in the cold months. The inference from this, during the period of the mid 16th century into the mid 19th century, characterizes northern and central Europe as a time of relatively high precipitation with a far greater numbers of overcast days than the mean. This scenario would be consistent with the enormous and extensive glacial growth that occurred during this time.

Painters in the central and northern regions of Europe, as well as the entire population, would have experienced cold, gloomy days more than they would have experienced sunny, warm times. The coldest decade of the 16th century was between 1590 and 1600. The coldest period globally in the Little Ice Age was between 1678 and 1730. The coldest summer in recorded history was in 1720. The years between 1805 and 1820 were the coldest period in Europe. In 1816, snow fell in the middle of summer, and it became known as the "year without a summer" (Fagan, 2002, p. 170).

During the period of glacial growth, more factors influenced the weather. The sun diminished its output of radiation, and further cooled down the planet. These periods were known as the Maunder minimum, which spanned the years 1645 to 1715 and the Dalton minimum, which extended between 1790 and 1830 (Fagan, 2002). The sunspot activity of the sun directly correlates with the solar output of radiation, and these periods were the lowest amounts of sun spots recorded since the telescope was invented and measurements were recorded.

Magnifying these solar effects, major geological events occurred, which further contributed to the cooling during the latter period of glacial advancement. Between the years of 1812 and 1883, four catastrophic volcano eruptions took place: Soufriere in the Caribbean in 1812, Mayon in the Phillippines in 1814, Tambora in 1815, and Krakatoa in 1883. Of these, Tambora is described as, "the most spectacular eruption of the past 15,000 years" (Fagan, 2002, p. 55). These volcanic events ejected massive amounts of ash and particles into the upper stratosphere, which further blocked the already diminished output of the sun, and caused greater cooling of the earth. Tambora was, by orders of magnitude, the largest eruption, and it is directly responsible for the year without a summer in 1816.

An analysis was published in 2001 by the British Ecological Society on tree growth growing in the Penningholmen region of Sweden, which included the genus, *Pinus*, among other species (Pfister, 1980). The study spanned the time preceding the Little Ice Age, known as the Medieval warming period beginning in AD 500 to the present day. Using the paleoecological method of counting pollen over this span of time in the soil record, a clear picture is established of the fluctuation of *Pinus* in this region over this span of time and corroborated the temperature analysis for this period as well as the glacial period. The poorest growth period for this genus directly registers with the period of the glacial advancement. The success of this species would depend on the temperature of the growing season, the quantity of light in the environment, and the the amounts of precipitation. Glacial advance would require high levels of precipitation, low levels of direct sunlight, and cold temperatures. The

limiting factors for this species would be low light and cold temperatures, and this is what the paleoecological record shows for the period of 1546 to 1850.

Before 1546 and the period of glacial advancements, there are examples of paintings using the intensity of complimentary colors to enhance the narrative the the works. This however needs to be moderated by the fact that the colors red and green played a significant role in relaying symbolic meaning. Jan van Eyck and Dürer made this color choice such that, by happy coincidence or as a conscious intention, this combination effectively served to relay the intended memes the artists envisioned.

The northern European painters, from the time of Jan van Eyck, kept to a path rich in realistic representationalism. The Mannerist period of Italy did not impact the art from this region. This is due primarily to the effects of the Protestant Reformation under the influence of Martin Luther, who posted his *95 Theses* on the Wittenberg church door in 1517, and John Calvin who published his work, *Institutes of the Christian Religion,* in 1536. As Leslie P. Spelman (1951) said, "although the results of the movement were almost immediately felt in the field of religion, and a little later in political and social life, the effect on the arts was somewhat more gradual, but nonetheless far-reaching and profound" (p. 166). Luther (as cited in Spelman, 1951) held a more favorable position on art with regard to the Church than did Calvin. "I am not of the opinion that all arts are to be cast down and destroyed on account of the gospel, as some fanatics protest" (p. 167). Calvin was not so open to the arts, but the northern European region was more influenced by Luther. By the time the Bank of Amsterdam was founded in 1609, the commercial world of the region, combined with

the absence of focus on art as a religious tool, cultivated a growth of realism in paintings of the period. Artists were incorporating symbols and memes within their paintings, as is seen in the works of Holbein, Dürer, and van Eyck, but their framework to do this was in capturing reality as a context with great fidelity.

The abundant realism from the Northern European artists of this period offers an accurate view of the conditions of that time because of the emphasis on realism. This makes them especially useful in determining the environmental conditions when a given work was painted.

CHAPTER VI

THE PAINTINGS

Jan van Eyck, *Arnolfini Portrait,* AD 1434

Jan van Eyck's *Arnolfini Portrait* (see Appendix, Figure 7), painted in 1434, is one of the most celebrated paintings of the Quattrocento in northern Europe. An abundance of interpretations have been offered regarding the meaning or meanings behind it. Much has been written on the matter of this portrait, but the subject is generally thought to be the betrothal of Giovanni Arnolfini and Giovanna Cenami (Janson, 1997). The man and the woman cover a large percentage of the picture plane, the man to the left of center and the woman to the right. Highly detailed renderings of various objects adorn the room, with a rounded, circular mirror centered in the top third of the panel. Fresh fruit, probably a peach or a plum, can be seen on the window sill and a table on the left-center, meaning that the seasonal period is somewhere in the middle to late summer. Contrary to the modern expectation of summer, both individuals are heavily covered in what appear to be thick winter attire, suggesting that the weather is much colder than the season would suggest.

Cold weather in the warm months was documented by van Eyck in the *Arnolfini Portrait.* Analysis shows that from the 1430s, Europe suffered extremely cold winters (see Appendix, Figure 7). The *Arnolfini Portrait* was painted in 1434,

which makes the work an excellent form of corroboration for the scientific evidence. This cold decade warmed by 1440. Even though the weather would still not have been stable, the severity would have diminished. By the time Dürer was painting in the early 1500s, the weather had largely improved, although temperatures were below the overall mean.

This is a period of the rise of individualism, and commercial enterprise was flourishing in Flanders, a region currently incorporating northern Belgium, the Netherlands, and parts of France. Painted only 86 years after the the beginning of the Black Death and only 68 years after the last large-scale recurrence of the disease, it demonstrates the increased material prosperity attained by those those who survived, which continued through to their heirs. The historian, James Burke (1995), in his book, *The Day The Universe Changed,* comments,

> After [the Black Death] was over, towards the end of the fourteenth century there was a new air abroad, a feeling of reckless joy at being alive. The survivors were rich, having inherited what the dead had left, so they went on a gigantic spending spree in an effort to wipe out the memory of those horrific years. . . . All over the Continent the workers flexed their new-found industrial muscle, in displays of political insurrection that would have been unthinkable a generation before. . . . In an attempt to stem the tide of revolution and hold down the trouble (such as the savage riots and disturbances in Burgundy, the Continent's richest state), the Franciscan friars preached a new, individual form of salvation. (p. 57)

Philip the Good (1396 to 1467), also known as Philip, Duke of Burgundy, was the patron of Jan van Eyck (Philip the Good, n.d.). Not only the court painter, van Eyck was also a diplomatic liaison for the Duke. He was well traveled and would have been knowledgeable on the current state of affairs throughout Europe. Van Eyck was known to have traveled to Spain in 1427, Portugal and England in 1428, and possibly

Prague in 1436 (Philip the Good, n.d.). The Prague trip is particularly insightful because it is two years after the end of the Bohemian Wars, where Hussites fought and defeated five separate crusades sent by the Holy Roman Empire, known as the Bohemian Wars. Hussites were followers of Jan Hus, a Czech priest from Prague who advocated Church reforms and who was burned at the stake in 1415, over 100 years before Martin Luther nailed his *95 Theses* to Wittenberg church. The Hussites were followers of Jan Hus, and their success against the Holy Roman Empire marked the beginning of what would later become known as the Reformation. Philip had intended to wage a campaign against the Hussites, but these plans never came to fruition, and this trip by van Eyck may have been to form a political alliance by marriage with Prague after the end of the Bohemian Wars in 1434 (Philip the Good, n.d.). Marriage negotiations were the focus of van Eyck's diplomatic duties. It is in keeping with those responsibilities that the *Arnolfini Portrait* should be interpreted. Symbolism is a common feature of his work. In his paper, "Symbolism as Enactive Symbolism in Van Eyck's Paintings," John L. Ward (1994) describes him as,

> An artist who set out to surprise and delight his patrons and to test the limits of painting by creating a depicted reality not only possessing amazingly naturalistic light and textures, but one that also overcame the static nature of pictorial imagery through a disguised symbolism designed to unfold gradually in the process of meditation. (p. 26)

Peaches and plums belong to the genus, *Prunoidae*, and originate from China. The use of this particular fruit in this painting demonstrates the reach of the Flemish in commerce at this time. This fruit would have been an expensive import from foreign lands. Peaches are the more plausible of the fruits, given that it is a symbol of long life

in the Chinese culture (Simpson, 1986). This adds further weight to the hypothesis that the elements of the painting are centered around espousing marriage as a virtue.

Dividing the picture plane from the lower left to the upper right separates the panel in to two triangles. With this demarcation, the scene takes on two distinctive tones. The left portion of the artwork includes Giovanni Arnolfini, and it has a low level of saturation throughout the geometry. With exception to a small portion of the bed at the top of the triangle, the red peaches on the window sill and a small section of a red chair in the background, the triangle is almost entirely a neutral brown. The heavy coat that Arnolfini wears borders on black. The hat is devoid of color and value, except highlighted edges resulting from their exposure to the directional light source, which is on the upper half of the left edge of the picture plane. The entire painting has soft, diffuse lighting.

The surface area of the right triangle is almost entirely made up of Giovanna Cenami in a saturated heavy, green dress with gold borders and a white cloth on her head. Almost all of the remaining portions of this triangle, except for the bottom left, which is filled with the lap dog, are saturated red. The highest value area of a painting is most often the main subject, and in this case it would be Giovanna Cenami's head. Green is associated with freedom, life, bountifulness, renewal, and fertility. Green could also have negative connotations during the Medieval period. It could also symbolize unrestrained sexuality and demons (WebExhibits, 2010). Her physical condition seems to be that she is in the late stages of pregnancy. The symbolic

purpose of green is unclear, as Giovanni Arnolfini is holding up his right hand to take a betrothal.

In Christian symbology, red refers to the Holy Spirit, and it is the color of Pentacost (Henderson, n.d.). It is also the color of charity. The population would not recover from the Black Death for a couple of centuries, so being noticeably pregnant before marriage would not carry the severe consequences in previous centuries. It is most in keeping with the memes of the day that she is the symbol of life and renewal, and thoroughly enveloped and sanctioned by the Holy Spirit to bring forth life from their bed. Those two colors in combination carry enormous symbolism to those who are the survivors of the previous century's devastation. Van Eyck is delivering the message that life is continuing, secular life is prosperous, and it is blessed by God. By virtue of the use of these complimentary colors, van Eyck is celebrating, not only the story of the Arnolfini's, but also the promise of life.

As powerful as the colors red and green are, the combination of the two in direct association draws the viewer in and adds additional depth to the work. This had been used by other artists before van Eyck, but not in the magnitude of the swaths of space as is found in the *Arnolfini Portrait.* Melchior Broederlam, appointed to the court of Burgundy as court painter before Van Eyck in 1391 (Janson, 1997), used the combination for the clothing for Joseph in *Annunciation and Visitation* in 1399. Mary and the Angel Gabriel are placed in a space that is filled with a variety of details and colors, which detracts the eye from focusing on Mary. The disruption of such elaborate detail and such varieties of color distract the eye from Mary and make it easier to

focus on Joseph. He is not the subject of the work from an ecclesiastical point of view, and yet the use of those colors magnify his presence, which is further enhanced by the use of an uncomplicated background painted in neutrals and browns.

Renaissance artists perceived color to be an inherent characteristic of an object, and this true state was affected only by direct light and shadow. James S. Ackerman (1980), in his paper, "On Early Renaissance Color Theory and Practice," describes environmental conditions, such as diffuse light from a overcast sky or other phenomena to have "slightly negative overtones" (p. 12). The ideal was preferred over the actual. Other than mixing white and black to adjust value, no process or technique was used at that time to adjust color using other colors. What was red was only red with only values changing. What was green was only green.

Moretto da Brescia, *Pietà,* circa AD 1520

The use of green and red on St. John the Evangelists' robes in Moretto da Brescia's *Pietà* is a case in point of the effects of complimentary colors (see Appendix, Figure 8). If the red and green were replaced by colors with the same values and saturations, but aligning the colors more adjacent to each other on the color wheel, a markedly different tone to the picture is achieved (see Appendix, Figure 9). The focus of the piece is the body of Jesus, but the position of the body, the direction of the river, and the vertical positioning of the structure behind St. John all direct the eye to the most vivid and intense element of the picture—St. John. He stands out as a result of both the composition of the elements of the piece, but primarily as a result of the artist's use of complimentary color.

Lacking the use of green and red, as in Figure 8, the subject of the picture is clearly the body of Jesus. All of the positions and angles of the objects in the scene make this obvious when the complimentary colors of the robes of St. John are removed and replaced with colors that are in greater alignment with each other. The artist, then, had in mind to make St. John the most striking element of the scene, so much so that he intended him to be the major focus of attention. It would not be in keeping with 15th century European mindset to overtly diminish the role of Jesus in a painting. If blatantly done, this could have been cause for severe consequences. With the use of complimentary colors, Brescia has effectively achieved this without violating the painting conventions of the period, which were used to define the subject mater of a picture. The artist has been able to propagate a meme in reference to the importance of St. John the Baptist in his contemporary culture.

If Brescia's *Pietà* is altered to greyscale, the meaning changes dramatically. It is now apparent that the Virgin Mary, St. John, and Mary Magdalene form a circle with the center formed by Jesus. Mary Magdalene, for centuries, carried the label or meme of being a prostitute. Yet the greyscale image enhances the impression that she is the foundational support for the body of Jesus, and the Virgin Mary and St. John are merely playing a supporting role in the composition. This is relevant since paintings in the 15th century would be typically viewed in dim to poor lighting. The eye would thus register mainly greyscale shapes, and the viewer would have potentially received this view of the picture and not one seen by the contemporary viewer in the National Gallery of Art. The meaning would dramatically change. In this light, the picture

clearly reveals the squaring of the circle and the Star of David as the subject of the work. Although the red color could possibly be identified in lower light, the potential meaning for this is not clear. It could be an artifact of the initial choice of using red/green in the piece for well light viewing and drawing attention to St. John

Brescia's *Pietà* is an excellent example of how the meaning and memes will change given the quality and quantity of light available to the viewer. Brescia clearly had neo-Platonic ideas and sacred geometry in mind during the execution of the composition (see Appendix, Figure 10), and he seems to have deliberately communicated unrelated memes as the viewing and lighting conditions changed. Complimentary colors plays a crucial role in one message in the painting and in diminished light. The use of values plays another role in delivering an entirely different one.

Albrect Dürer, *The Four Apostles,* AD 1526

Albrect Dürer exemplifies the use of color in inherently pure terms in his two panel work, *The Four Apostles* (see Appendix, Figure 11), painted in 1526 and presented to the city of Nuremberg after the city had become Protestant. The left panel contains John to the left of the picture plane and Peter behind him to the right. The right panel has Paul in the foreground and center right, and Mark in the background. Placed together, John and Peter are facing each other. John, to the left, and Peter, to the right, are the central figures of the combined piece. While Peter and Mark, on the right, are painted in neutral tones approximating greyscale with the exception of Peter's Bible, John fills the left panel with a bright red robe with saturated green clothing beneath it, visible on the chest, the right hand, and above the feet. The

substrate John and Paul are standing on is a diminutive green, while Peter and Mark stand on neutral grey/brown floor. The inside lining of John's red robe is gold, which is exposed on his left shoulder and arm. John is covered by the only saturated colors in this two-panel work.

John has been singled out among the four most important apostles to Protestantism to be endowed with the pure colors of red and green. Using the Christian interpretation of color usage, John would be wrapped in the Holy Spirit, which is lined in the gold of love and purity. This juxtaposes the other three. Peter is the dominant figure on the right panel, and he is entirely covered in neutral to white robe. Christianity uses white to symbolize the memes of innocence and purity. Mark does not occupy space on the panel other than his head and a portion of his right hand and foot. There is no indication of the color of his robe. Paul has only a portion of his robe showing, which is grey. Peter holds a walking stick in his right hand, and using that object to ground him to a more earthly message, an interpretation can be inferred that John represents the metaphysical of the Christian teachings while Peter embodies the delivery of the message of the metaphysical. Color is directly expressing memes in this work, but the artist has also used complimentary colors, deliberately or not, to elevate John as the most important element of the piece. Even in greatly diminished light, John and Paul will clearly stand out as the primary message of this work.

Hans Holbein, *Henry VIII,* AD 1540

A change also takes place in the use of color and traditionally associated memes. Hans Holbein the Younger was a contemporary, and a peer in terms of talent,

of Dürer. A native of Switzerland, he gained international fame and became the court painter for Henry VIII (Spelman, 1951). Holbein painted a skillfully rendered and realistic representational portrait of Henry in 1540 (see Appendix, Figure 12). The importance of this painting lies not in the excellence of its depiction of the subject, but in the colors he chose to portray his subject. The subject fills the panel, with only the upper most left and right sides exposing a dark, saturated green background. The clothing of the arms and shoulders are gold, embroidered with jewels and elaborate designs. The torso is also intricately laden with jewels and ornate designs in the fabric. Beneath the ornamentation is a darker, saturated red. In effect, the entire painting is dominated by red and green and highlighted by gold.

Through the Act of Supremacy in 1534, Henry VIII split from the Roman Catholic Church and appointed himself as the head of the Church of England. He became not only the sovereign of the English people, but also its spiritual leader. Holbein had rejected Catholicism in 1528 (Janson, 1997), and the portrait is clear evidence that he was using his skill to promote this new form of monarchical rule. Holbein uses the same color combination as Dürer used for John, but instead of using the colors to single out an element of the painting, the entire panel is covered with red and green, with highlights in gold. The movements of the king's arms, and by association the actions of the state, are surrounded in the gold of innocence and purity. In the Christian tradition, green has another meaning, that of freedom from bondage and the breaking of shackles. The vision that Holbein has produced for Henry VIII is

one of a king free of bondage, covered in the Holy Spirit, and able to act with righteousness.

The metaphysical and moral memes connected with these colors elevate the secular monarch to that off a spiritual potentate. The king is the human embodiment of the state, and by virtue of the king's elevation to this new position, which now encompasses both the secular and the spiritual, the nation-state is endowed with these properties in like kind. Holbein delivers the message that the Act of Supremacy has consecrated the king and the realm, and correspondingly it declares any actions taken by the king through the state as righteous.

Like the *Arnolfini Portrait,* Holbein effectively uses the compliments of red and green to add intensity to the picture, and like van Eyck, he has used the symbolism of these colors to incorporate the spiritual into the representations of objects in the real world, thus alluding to the presence of the divine in worldly affairs. Holbein has taken the technique of integrating spiritual symbology with secular material further by fusing the spiritual and the secular in political affairs.

Caravaggio, *The Entombment,* AD 1602-1603

Michaelangelo Merisi, commonly referred to today as Caravaggio, is arguably one of the greatest painters to ever live. Gilles Lambert (2001), in his book, *Caravaggio,* says of him,

> [Caravaggio] is now considered the most important painter of the early Baroque period; without him there would have been no Ribera, Zurburán, Velázquez, Vermeer, or Georges de la Tour. . . . In painting, Caravaggio is the apotheosis of what was later called the 'Baroque'. (dust cover)

Following the Mannerist period of the 1500s, and rejecting every notion of the deformed, surreal, and impossibly positioned elements found in that style, Caravaggio brought back the proportional realism, balanced spacing, and perspective which had seen little use in the middle and latter 16th century. When he began work in the early years of 1600, his fame spread throughout Europe, and would-be apprentices from as far as the Netherlands came to Rome to learn from a master who had just turned 30 years old (Robb, 1998). Always working with models and not using any detailed drawings, his pictures remain demonstrations of representational painting of the highest order. What he changes from the geometric precision of his Renaissance predecessors is action and life. Of his stylistic point of view, Peter Robb (1998) says in his book, *M: The Man Who Became Caravaggio,* "he rejected ideas and ideals . . . all he cared about was life, getting life right" (p. 8). Contrary to a stoic moment in time, which alludes to the ideal in neo-Platonic thinking, Caravaggio paints the climactic instant of an event where emotions are at their zenith.

The Roman Catholic Church adapted its use of imagery to counter the advances of the Reformation and handed down strict dictates on the nature, style, and overall decorum of religious paintings, which included the elimination of eroticism, pagan topics, and anything that could be construed as heretical. Cesaere Ripa's iconography book, published in 1593, became the reference for understanding symbology in the Catholic faith, and was commonly cited for over a century. A strict compliance to the approved story line the Vatican decreed was levied throughout the

Catholic world as Mannerism faded. This temperament in society in no way conformed to the disposition of Caravaggio.

Of Caravaggio's surviving paintings, which are approximately 40 in number, *The Entombment* (see Appendix, Figure 13), painted in 1603, has received high praise (Moir, 1989). It was painted for the church of the Chiesa Nova of Santa Maria in Vallicella. In the gospel of John, the group that attending to the entombment of the body of Jesus was Joseph of Aramathea, Nicodemus, Jesus' mother Mary, Mary Magdelane, and Mary Cleophas. The Virgin Mary is centered in the scene, with arms outstretched, encompassing Mary Magdalene, Nicodemus, and Joseph. Mary Cleophas is upper right, with both arms reaching up to the sky. She is not included in the gesture by the Virgin Mary. Joseph and Nicodemus are holding the body of Jesus. The body, along with the shroud, contains the highest values in the image other than a small amount of white around the head of the Virgin Mary. It is positioned horizontal to the picture plane and slightly below the center line of the picture.

The hierarchy of these figures in the Roman Catholic Church would suggest that, other than the body of Christ itself, the Virgin Mary would be the most important figure to portray in this work. In his book, entitled *Caravaggio,* art historian Alfred Moir (1989) said, "[Caravagio] must have had [Michaelangelo's *Pieta*] in mind as he painted" (p. 96). Michaelangelo's masterpiece placed the Virgin Mary sitting and holding the dead body of Jesus and she is the object of focus, which is not the case in this painting.

Nicodemus is a Sanhedrin, a Jewish Judge. This group tended to favor the teachings of Jesus. As a high official, the expectation is reasonable that he be dressed in attire appropriate to his position in the community. However, Caravaggio has painted him in the clothes of a peasant. The figure covered in the greatest amount of shadow is Joseph. His head and chest are almost entirely in complete shadow. Contrary to this, Joseph is the only one of the group who has saturated robes. His clothing is a rich, saturated green and red, and all else in the picture space is neutral to unsaturated color, with the exception of a small green plant in the lower left of the picture plane. This intense coloration of clothing, surrounded by browns, greys, and black pulls Joseph out of the image and brings the focus to him and thus makes him the actual subject of the piece. This not only runs counter to the Christian expectation of Roman teachings regarding the relative importance of the characters in the scene, but it also stands in conflict to the purpose of the painting. It was commissioned for the Vittrice family chapel in the church of Santa Maria in Vallicella (Moir, 1989).

The patron of this church is Mary and the implications of the story, the mother loses the child, indicate that the Virgin Mary is the subject of the plot. Caravaggio, however, has deliberately remade the narrative. Using the red and green combination, Joseph is the definitive focus of attention in the painting. It is speculation to attribute the traditional symbology of Holy Spirit and rebirth to these colors in this instance, particularly in light the nonconformist nature of the artist, but it is clear that Caravaggio deliberately intended for viewers to be predominantly drawn to Joseph above all the other characters. The meme, which Caravaggio intended may not be

clear from a distance of 400 years, but by the color choices he made we can infer that it centered around Joseph of Aramathea.

El Greco, *Saints John the Evangelist and Francis*, AD 1604

In 1525, Mannerism begins in Italy as not so much as a style of painting but as a timeframe, which lacks definitive technique. What can be said of this period is that much of the work produced lacks a realistic representational quality and is laden with a high degree of stylization. Artwork from Italy and Spain are primarily the source of this type of painting, while the northern and Flemish regions continued with representational, realistic images.

In Spain, El Greco exemplified the style of Mannerism in his career, which dated from 1577 to 1614. His work heralded what was to come in the late 19th and first half of the 20th centuries in the works of artists such as Munch and Klimt. As far removed from the tradition of realism, which dated from the Renaissance, there are memes, which have successfully made their way into his work. The painting, *Saints John the Evangelist and Francis,* dated from 1604, incorporates the traditional red and green combination seen from Dürer 74 years before and Caravaggio only 2 years preceding this work. In a Catholic country where the Reformation could not reach, El Greco passes along the memes associating the Holy Spirit with red and purity and rebirth in green.

There is a new property to El Greco's *Saints John the Evangelist and Francis* (see Appendix, Figure 14), which speaks to the environmental conditions of the day. This painting includes a heavily overcast sky as the background. This is also true of

much of his other work. In the present day, Spain has a relatively dry, sunny, and temperate climate. In his day, El Greco saw it in a considerably different light. Overcast and gloomy cloudscapes are found throughout his entire body of work such as,

- *Christ on the Cross Adored by Two Donors* (see Appendix, Figure 15)
- *View of Toledo* (see Appendix, Figure 16)
- *The Holy Family with Mary Magdalen* (see Appendix, Figure 17)

The subject matter of some of these paintings may have called for the use of a gloomy sky. Cloudy days may also have been a motif the artist had cultivated as a meme that identified him as the creator of a given picture, but the ubiquitous presence of overcast skys throughout his entire portfolio suggests that cloudy and gloomy days were an ever present aspect of his life and directly affected his work throughout his career. The Spanish Armada, while sailing to conquer England, had been devastated by intense storms only 16 years before *St. John the Evangelist* was painted. The environment played as much of a role in affecting this and other painters as it did in directing human affairs during the time of the glacial advance.

Anecdotal evidence of cold and varying conditions can be inferred through the work of the Dutch painter Pieter Claesz, who worked between the years of 1620 to 1656. As a still life painter, his work involves the use of every day items and typically centers around food. A staple found in his work are various types of seafood. Fish, in particular herring and cod, are a mainstay of the Dutch diet. A representative meal at breakfast would likely include fish. Since fish and other foodstuffs are perishable,

Claetsz' choices at any given time would be limited to what the market had available at the time of a given painting.

Over time, Claesz modified his style, going from simple associations to complex and elaborate settings. His work often included a deeper symbolic meaning and extolled the Protestant virtues of the time such as virtue and moderation and often referenced the brevity of life and the passage of time (Biesboer, 2004). The variety and complexity of his work do not lend itself to a direct cause and effect answer to the relationship of climate to his subject matter. However, some noteworthy patterns do exist. During the decade of the 1620s, the use of fish and seafood in his pictures and as a subject are common. That frequency diminished throughout the 1630s. In the next decade, the return of fish as a subject becomes prevalent. The painting, *Still Life with Gilt Goblet* is such an example (see Appendix, Figure 18). The 1640s were also a time in which the compositions become much more opulent and lavish. This ebb and flow of the use of fish may suggest the accessibility Claesz had to acquire fish as a subject.

Herring and cod are predominant as a staple for his region, and they are the most common species found in his work. These two types of fish have an aversion to cold water, and when their territories become colder, they will migrate to southern and warmer climates. During these periods, the availability of herring and cod become either diminished or entirely unavailable. This migratory phenomenon may be indicated in Claesz's paintings of the period.

At present, there is no paleoclimatic or bioclimatic evidence directly targeting these years, but it does follow patterns which are documented in several other periods. In 1588, William Camden (as cited in Fagan, 2002), a British geographer, wrote, "these herrings, which in the times of our grandfathers swarmed only about Norway, now in our times . . . swim in great shoals round our coasts every year" (p. 116). From 1680 to 1720 Norwegians began a successful lumber exporting industry, because the growing season made it difficult to farm, and the herring were not available in their waters (Fagan, 2002). It is possible that Claesz has provided an indirect visual record of the migration of these species, which directly corresponds to temperature changes in North Sea and Atlantic waters during his career. Further scientific research may correlate this assertion and add more evidence to the relationship between climatic change, human experience, and art. Until that time, the subject matter Pieter Claesz used throughout his career and its connection to ocean temperature remains an interesting possibility and worthy of further study.

Peter Paul Rubens, *Prometheus Bound,* AD 1618

In 1618 Peter Paul Rubens made use of blue in a unique way in his painting, *Prometheus Bound* (see Appendix, Figure 19). This piece conceptualizes the myth of Prometheus, capturing a moment from one day of his punishment for bringing fire to humanity. A vulture tears out his liver and eats it, as is his fate for each of the endless days of eternity. In this gory scene, the striking absence of blood red stands out above all else. Rubens kept this piece in his private collection, so the personal importance of this work and the artistic decisions he made regarding the composition demonstrate

that these color choices were not only deliberate, but stood out for the artist as a greater achievement than other works. Yellow/orange is the compliment of blue, and the body of Prometheus qualifies, although the value and saturation of the color are not consistent with the dark blue he chose for the robe beneath his body. The striking effects of truly aligned compliments, with equivalent saturation and value, are not present upon a viewing of this artwork, but these near compliments greatly enhance the impact and draw the focus to Prometheus.

Prometheus Bound was not created in the time of indigomania, but blue had a considerable popularity in the early 17th century. In the typical fashion of Baroque art, the subject is caught up in the action of the moment and is posed in an unbalanced and awkward position. The body lacks a realistic proportion or form and is, thus, outside of the realm of the idealized body of classical antiquity, which is a common trait among Baroque pictures. The high degree of detail suggests a snapshot of the event, as if it were a photograph taken with high speed film. The unwieldy positioning of the subject and the vulture defines this instant of time, which in the real world would be seen as a brief glance. This brevity of the pose is inconsistent with the high degree of detail in the subject. While the body has no realistic shape or proportion, it has an overabundance of detail. The visual system does not process detail when identifying movement as a camera does. Henri Matisse (as cited in Livingstone, 2004) said in regard to this phenomenon,

> Movement thus understood corresponds to nothing in nature: when we capture it by surprise in a snapshot, the resulting image reminds us of nothing that we have seen. Movement seized while it is going on is meaningful to us only if

> we do not isolate the present sensation from that which precedes it or that which follows it. (p. 77)

The background is a dull, unsaturated green, with greatly diminished detail relative to the subject. This further focuses the viewer on the subject, and prevents the eye from being distracted from the intended center of attention. The blue robe has the illusion of supporting Prometheus, and since there are no saturated warm colors like blood, there is a diminished feel to the piece. If red were used at all or in proportion to the grotesque actions taking place, a much higher level of excitement would be produced in the viewer. As it is, the picture illicits more of an intellectual feel than one of horror.

The painting was completed in 1612, which is the same year that the great scientist and astronomer Johannes Kepler published, *Astronomia Nova,* his opus, which mathematically defined the motions of the planets. This was a period which had begun to see the rise of the Age of Reason and the subsequent diminishment of superstition. The Protestant Reformation was nearing its end, the authority of the Roman Catholic Church had receded, commerce was expanding, and the Bank of Amsterdam had been founded. As much an international emissary as artist, Rubens was quite aware of the events of the day and was deeply knowledgeable and involved in much of European politics. Consequently, this painting seems to capture the feel of an age more directed toward the secular and deliberate analysis of the world rather than the subjugation of individuals by memes associated with church authority. Blue, as the color associated with nobility and fidelity, is an appropriate choice for drawing

attention to the subject. Prometheus brought fire, as the time of Peter Paul Rubens brought forth the memes of the Enlightenment brought forth a new paradigm.

Jan Steen, ***As the Old Ones Sing, So the Young Ones Pipe,*** **AD 1675**

Jan Steen's main subject centered around family life and the dynamics of the household. His fame became so well known with regard to this that the term, a Jan Steen household, was coined, which referred to disorder in the house (Dominicus & Jungschleger, 2003). The painting, *As the Old Ones Sing, So the Young Ones Pipe* (see Appendix, Figure 20), is a typical example of his work. A family is celebrating, and a variety of amusements are taking place. The family is engaged in playing music, singing, smoking, drinking, and eating. The subject of the piece involves the warning of excess practices and the negative example it sets for the children (Dominicus & Jungschleger, 2003). It is also a timepiece of the conditions of the time.

The focus of attention is the woman, with right breast exposed, holding a child with her left arm. The eye is attracted to her through several devices. She is the brightest of the centered objects, but as is characteristic of Steen, many elements direct the eye to her, and most of these are red. Lower left in the picture plane, the old man playing a stringed instrument has a red shirt, which is positioned to guide the eye down the neck of the instrument. The eye then follows the flute, played by the small boy, which directs the viewer to the red wine in the glass held by the woman and then the reflected light on her arm provides the final guide. Lower right in the picture plane, the old woman wears a red shawl. The lower edge of the garment, bordering on black, provides a linear vector to the woman. The right arm of the baby, wearing red, is

pointing to the woman's head. Using red, Steen makes it known that the woman is the subject of the piece.

In a nearly identical painting from 1668, entitled, *The Merry Family,* Steen painted a piece of paper in the picture plane which says, "Soo d' oude Songen, Soo Pypen de Jonge." Translated to English, it means, "As the Old Sing, So Pipe the Young" (Dominicus & Jungschleger, 2003, p. 124), which is the title of this painting. The festive tone of the piece has within it excesses, such as the young boy drinking wine in the lower left of the picture plane. Steen uses red not as van Eyck, Dürer, or Holbien have, as a component associated with religious symbology, but as a tool to focus the attention of the viewer on the actual subject of the piece. This is an entirely secular painting with no religious overtones but with a moral message. Red is being used as a guide for the viewer to find the actual meaning of the work, which is a moral message.

There is also a tree seen out the window in the upper left corner. The lighting is directional, but not strong, making soft shadows on all subjects and objects in the painting. Outside the window, in the distance, are clouds. A fresh peach and a lemon are on the table, suggesting that the setting is in the growing season. However, every individual is dressed for the cold. Hats, capes, and multiple layers of clothing are in conflict with what else is known in the visual field.

Steen painted *As the Old Ones Sing, So the Young Ones Pipe* in 1675. A few years before and just across the English channel, London had burned to the ground and suffered the most recent epidemic of plague. However, the Netherlands were well into

the prosperity of burgeoning capitalism and focused on secular prosperity. Practical, business matters were the main center of activity. To that end, Steen painted a moral lesson rendered in painstaking detail to resonate with a secular, prosperous society. The weather conditions can be taken as an accurate depiction of the conditions of the time.

The year 1675 was in the middle of a 70-year-long solar event known as the Maunder minimum. The sun goes through cycles of change regarding the heat, which is output, and this is directly correlated with features seen on the sun known as sun spots. The Maunder minimum was a time of record low sun spot activity, and this directly correlates with what is known of glacial expansion in the same period, as well as the relatively slow growth in the northern European pine forests. Jan Steen is not only providing a secular, moral lesson to the viewer, he has created a time capsule of the environment as it actually was.

Casper David Friedrich, *Abbey in the Oak Forest,* AD 1810

The coldest period on record for much of Europe was between 1805 and 1820. Fifteen years before, in 1790, another sun spot decline began that lasted until 1830. This was known as the Dalton minimum. Like its predecessor, the Maunder minimum, this period saw a noticeable decrease in solar activity, and thus less heat was received by the earth. This period also saw a decrease in pine forest growth and a great increase in glacial expansion. The year 1790 also saw the beginning of the Romantic movement.

Two major volcanic eruptions took place in this period, which further negatively impacted the climatic conditions. The first was Soufriere in the Caribbean in 1812. The second, and the largest volcanic eruption in 15,000 years, was Tambora in 1815. This eruption directly caused what was to be known as the year without a summer in 1816. From North America to Europe, the summer of 1816 saw sheep and cattle freezing to death, lakes freezing solid, and massive crop failures. This year also saw bread riots in France and massive unrest, in general, throughout Europe. There were so many starving in Zurich it became known as the year of the beggars (Fagan, 2002). Lord Byron, Percy Shelly, and Mary Shelly were confined that summer of 1816 in Byron's vacation home in Geneva where *Frankenstein* was written, which ended in the bitter cold of the arctic ocean.

The contemporary world had not seen conditions as extreme as those which fell into the timeframe of the Romantic period. From the modern viewpoint, the art of this time is often regarded as sentimental, idealistic, and somewhat naive. Robert Hooke proposed the wave theory of light in 1672, Christian Huygens published his wave theory of light in 1678, and Isaac Newton published his *Optiks* in 1704. These rationalists and others of the 17th century had effectively harnessed nature in the service of man. In 1689, John Locke had replaced oligarchy and aristocracy with egalitarian rule. Protestantism had removed the authority of the Church, and commerce had redirected the cultural focus on secular concerns. With the extreme and often devastating environmental conditions of the era, the Romantic period was not born from a desire to revisit past of mysticism or pagan superstition, but rather to see

the world as it was at the time, as ruthless and horrifying. God was not apportioning punishment. Within this cartesian world, the Romantic period saw nature as the master, not man. Nature was not in the service of man, man was subservient to nature and it was a sublime sovereign.

Among the painters of the Romantic period, none captured this state of fear and wonder like Casper David Friedrich. He was a Rosecrucian, which was a medieval German secret society of mystics. His art always had some symbolic memes associated with his religious point of view, and this symbolism always incorporated nature. Terms like estrangement and alienation are often used to characterized Friedrich's work, but Oskar Kokoschla (as cited in Schmied, 1995) may have described it most succinctly, when he said,

> Casper David Friedrich, a loner, suddenly sees with horror and with eyes wide open how terrifying nature is, how lost the individual is in the world—in contrast to the academic, classicist idea of a falsely romanticized nature in the bucolic sense. (p. 25)

In the second volume of his memoirs in 1865, Carl Gustav Carus (as cited in Schmied, 1995) described the *Abbey in the Oak Forest* (see Appendix, Figure 21) as, "perhaps the most profoundly poetic work in all of modern landscape painting" (p. 64). The work is set either at sun rise or a sun set, with the remnants of an abbey wall partially lit, with oak tress without leaves surrounding it. The ground is covered in snow and mist is rising, partially obscuring the aging head stones of graves in the foreground. The piece is painted in values of earth tones with an open sky of orange and yellow crossing into a complimentary blue before darkening to black at the top of the picture plane. The crescent moon is visible, with moon glow, two thirds up and to the right.

This subtle use of complimentary color changes what would have been a dull and depressing depiction into a stark but breathtaking masterpiece. Its genius is not as a representation as an idealized state, but one as a snapshot of the world as it is viewed from a perspective, which allows the viewer to meditate on existence as it is in Europe in 1809 and the limits of life, the power of a ruthless nature, and ones' place within it.

Casper David Friedrich, *The Polar Sea,* AD 1824

Freidrich's work, *The Polar Sea* (see Appendix, Figure 22), is another of his well known masterpieces. Like all of his artwork, there is symbolic, geometric meaning to the piece, but a less convoluted message are the objects themselves. Centered on the picture plane, a monumental block of ice sits like a mountain rising above a frozen ocean. Center right, the stern of a tall ship can be identified, crushed and partially covered by the ice, which totally covers the ocean from the foreground to the horizon line. To the left of the ice are splintered remains of what appears to be some of the tall ship's masts. Other ice mountains fade in the distance with no implied movement other than overcast skies. Desaturated blues and greys make up the color component of the background. The foreground, however, shows another masterful use of complimentary color. The base layers of the ice are painted in a desaturated green with bluish white layered to form the ice itself. The ice closest to the viewer is contaminated with a brownish red, alluding to dirt from ages past. The stern of the ship is green with red highlights.

The use of these reds and greens is more subtle than examples from the region in years past. They are not pure color, denoting an ideal, religious meme, but impure

and connoting the realities of earthly existence. Tall ships, the symbol of the strength and might of European nations, are shattered to bits by a nature, which is not affected in any way by its presence. The Northwest Passage had been attempted by Perry a few years before this was painted, and his failure to navigate the Arctic ocean to Asia is possibly the lesson Friedrich is attempting to make. Man will always be limited in his endeavors in the face of nature. Forces beyond human control are portrayed in red and green, not as an idealized, metaphysical construct, but as a very real and present danger to human endeavors.

Conclusion

Artists in the central and northern European region have used color to convey memes to the viewer in a variety of ways over the past 700 years. Color carries with it deeply ingrained memes, and religious connotations with various colors are a most effective tool to convey such a message. The environmental conditions greatly contribute to the choices an artist makes, and this is evident in the historical record of this region.

The Little Ice Age had profound and devastating effects on all aspects of life in the temperate areas of the globe. European artists painted images reflecting the environment of the time, and they chose colors based on the relatively poor lighting conditions available to the viewer. A more comprehensive survey, quantifying color regions and using a large sample group over the span of the Little Ice Age, would clearly correlate color with environment and light quality. This investigation opens a window to this phenomena and demonstrates that the work of artists are greatly

affected by the environment in which they work. In order for an image to effectively convey the intended memes, an artist takes into account how the viewer sees the work, and how the viewer interprets various colors.

REFERENCES

Ackerman, J. S. (1980). On early renaissance color theory and practice. *Memoirs of the American Academy in Rome, 35,* 11-44.

Aldrich, V. C. (1965). Mothersill and Gombrich: "The language of art." *The Journal of Philosophy, 62*(20), 572-573.

ArtStore, Inc. (n.d.). *ArtStore digital library.* Retrieved from http://www.artstor.org .source.unco.edu

Atalay, B. (2004). *Math and the Mona Lisa.* Washington, DC: Smithsonian Books.

Biesboer, P. (2004). *Pieter Claesz: Master of Haarlem Still Lifew*. Zwolle, The Netherlands: Waanders Publishers and Printers.

Briggs, D. (2008). Trichromacy and opponency. *The Dimensions of Colour.* Retrieved from http://huevaluechroma.com/032.php

Brodie, R. (1996). *Virus of the mind: The new science of the meme*. Seattle, WA: Integral Press.

Burke, J. (1995). *The day the universe changed.* Boston, MA: Little Brown and Company.

Dawkins, R. (1977). *The Selfish Gene* (1st ed.). Oxford, UK: Oxford University Press.

Dawkins, R. (1998). *Unweaving the rainbow* (1st ed.). Boston, MA: Houghton Mifflin.

Dominicus, M., & Jungschleger, I.. (2003). *Rijksmuseum: The masterpieces guide*. Amsterdam, The Netherlands: Kunstdrukkerij Mercurius-Wormerveer.

Fagan, B. (2002)., *The little ice age: How climate made history 1300-1850*. New York, NY: Perseus Books Group.

Foss, L. (1971). Art as cognitive: Beyond scientific realism. *Philosophy of Science, 38*(2), 234-250.

Gage, J. (1999). *Colour and meaning: Art, science and symbolism*. Berkeley, CA: University of California Press.

Gleick, J. (1988). *Chaos: Making a new science*. New York, NY: Penguin Books.

Goethe, J. v. (1810). *Theory of colours*. Mineola, NY: Dover Publications.

Guerlac, H. (1986). Can there be colors in the dark? Physical color theory before Newton. *Journal of the History of Ideas, 47*(1), 3-20.

Gurewitsch, M. (2008, July). True colors. *Smithsonian, 39*(4), 66-72.

Hedges, C. (2009). *Empire of illusion: The end of literacy and the triumph of spectacle*. New York, NY: Nation Books.

Henderson, C. (n.d.). *The significance of color in Christian symbolism.* Retrieved from http:www.godweb.org/color.htm

Hoeppe, G. (2007). *Why the sky is blue*. Princeton, NJ: Princeton University Press.

Hoekema, D. A. (1991). Artists, humanists, and society: Conservatives have the wrong answers, and liberals ask the wrong questions. *Art Journal, 50*(3), 45-48.

Jacobs, G. H., & Nathans, J. (2009). The evolution of primate color vision. *Scientific American, 300,* 56-63..

Jane Boch, P. (1985). *The Jane Boch lectures on evolutionary biology*. Boulder, CO: University of Colorado, Boulder.

Janson, H. W. (1997). *History of art.* New York, NY: Harry N. Abrams.

King, M. (1998). Concerning the spiritual in twentieth century art and science. *Leonardo, 3*(1), 21-31.

Lambert, G. (2001). *Caravaggio.* New York, NY: Midpoint Press.

Livingstone, M. (2004). *Vision and art: The biology of seeing.* New York, NY: Abrams.

Livio, M. (2003). *The Golden Ratio*. New York, NY: Broadway Books.

Lycan, W. G. (1971). Gombrich, Wittgenstein, and the duck-rabbit. *The Journal of Aesthetics and Art Criticism, 30*(2), 229-237.

MacCurdy, E. (Ed.). (2003). *The notebooks of Leonardo da Vinci: Definitive edition in one volume*, Old Saybrook, CT: Konecky & Konecky.

Matthews, J. A., & Briffa, K. R. (2005). The "little ice age": Re-evaluation of an evolving concept. *Geografiska Annaler, 87*(A), 17-36.

Merchen, B. (1997). *Color theory lectures.*. Seattle, WA: Art Institute of Seattle.

Moir, A. (1989). *Caravaggio*. New York, NY: Henry N. Abrams.

Perkowitz, S. (1998). *Empire of light*. Washington DC: Joseph Henry Press.

Pfister, C. (1980). *The little ice age: Thermal and wetness indices for central Europe. Journal of Interdisciplinary History, 10*(4), 665-696.

Philip the Good. (n.d.). In *Wikipedia, the Free Encyclopedia.* Retrieved from http://en.wikipedia.org/widi/Philip_the_Good

Price, L. (2001). *Dialogues of Alfred North Whitehead: As recorded by Lucien Price.* Jaffrey, NH: David R. Godine.

Rank, O. (1989). *Art and Artist*. New York, NY: W.W. Norton & Company. (Original work published 1932)

Robb, P. (1998). *M: The man who became Caravaggio.* New York, NY: Henry Holt.

Schmied, W. (1995). *Friedrich.* New York, NY: Hary N. Abrams.

Simpson, B. B. (1986). *Economic botany: Plants in our world*. New York, NY: McGraw-Hill.

Spelman, L. P. (1951). Luther and the Arts. *The Journal of Aesthetics and Art Criticism, 10*(2), 166-175.

Technical Advisory Service for Images. (2004). *Colour theory: Understanding and modeling colour*. Bristol, UK: Author.

Varichon, A. (2006). *Colors: What they mean and how to make them*. New York, NY: Abrams.

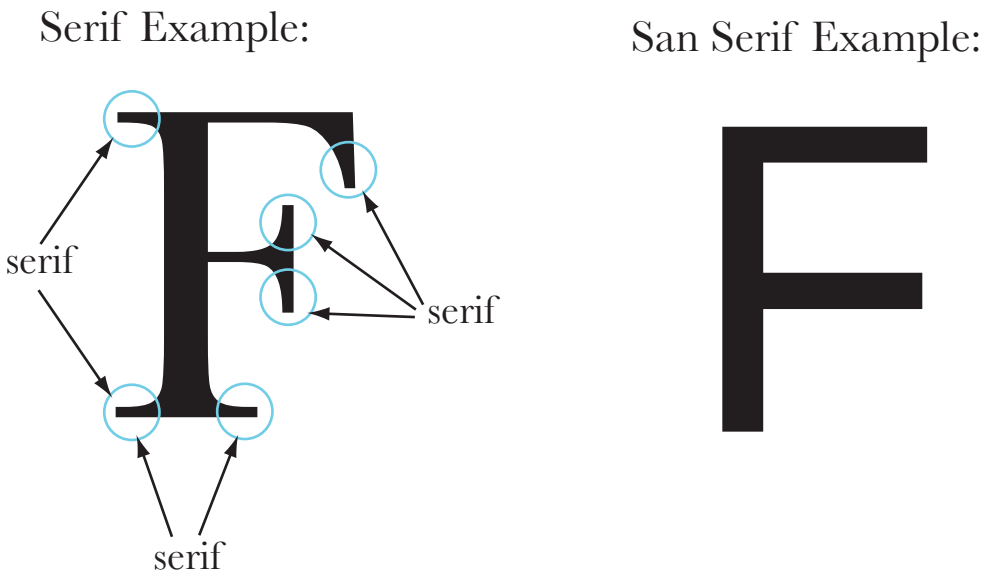
Ward, J. L. (1994). Disguised symbolism as enactive symbolism in van Eyck's paintings. *Artibus et Historiae, 15*(29), 9-53.

WebExhibits. (2010). *Pigments through the ages—Middle ages*. Retrieved from http://www.webexhibits.org/pigments

Williamson, S. J., & H.Z. Cummins, H. Z. (1983). *Light and color in nature and art*. New York, NY: John Wiley & Sons.

APPENDIX

ILLUSTRATIONS



Serif Example:

Emperial Bank

San Serif Example:

Emperial Bank

Figure 1. Peter A. White, serif font.

Figure 2. Kasimir Malevich, *Taking in the Rye,* AD 1912, Stedelijk Museum, Amsterdam. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 3. Cimabue, *Madonna of the Holy Trinity,* AD 1280, Church of the Trinity, Florence. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 4. Wassily Kandinsky, *Fragment II from Composition VII,* AD 1944, Albright-Knox Art Gallery. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 5. Claude Monet, *Hotel des Roches Noires, Trouville,* AD 1870, Musée d'Orsay. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 6. Peter A. White, painter's wheel.

Figure 7. Jan van Eyck, *Arnolfini Portrait* AD 1434, National Gallery, London. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 8. Moretto da Brescia, *Pietá,* AD 1520s, National Gallery of Art, Washington DC. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor .org.source.unco.edu

Figure 9. Moretto da Brescia, *Pietá,* AD 1520s (desaturated color), National Gallery of Art, Washington DC. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

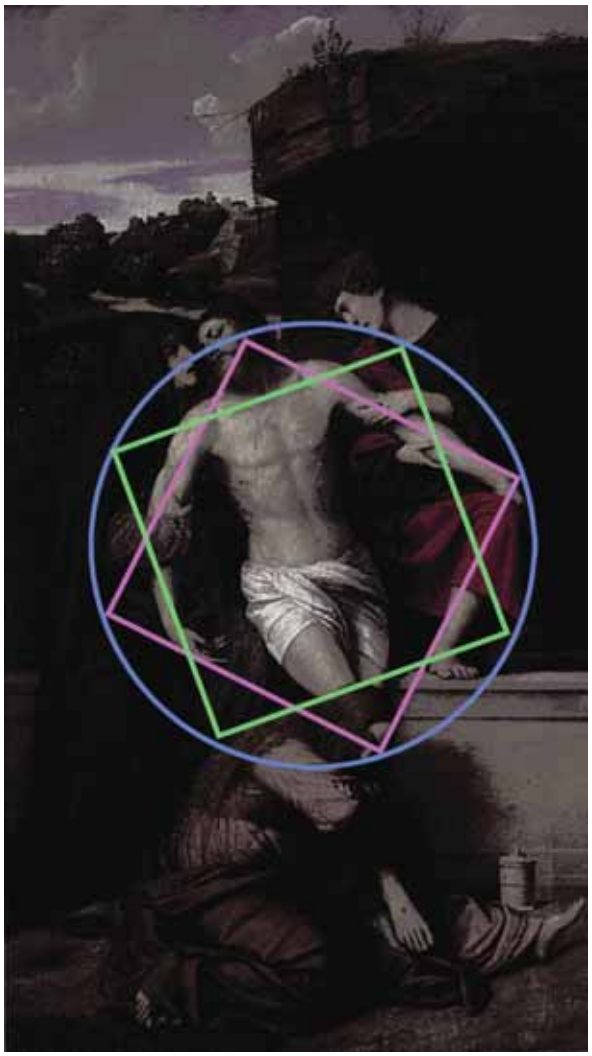


Figure 10. Moretto da Brescia, *Pietá* AD 1520s (Sacred Geometry), National Gallery of Art, Washington DC. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 11. Albrecht Dürer, *The Four Apostles,* AD 1526, Alte Pinakothek, Munich. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org .source.unco.edu

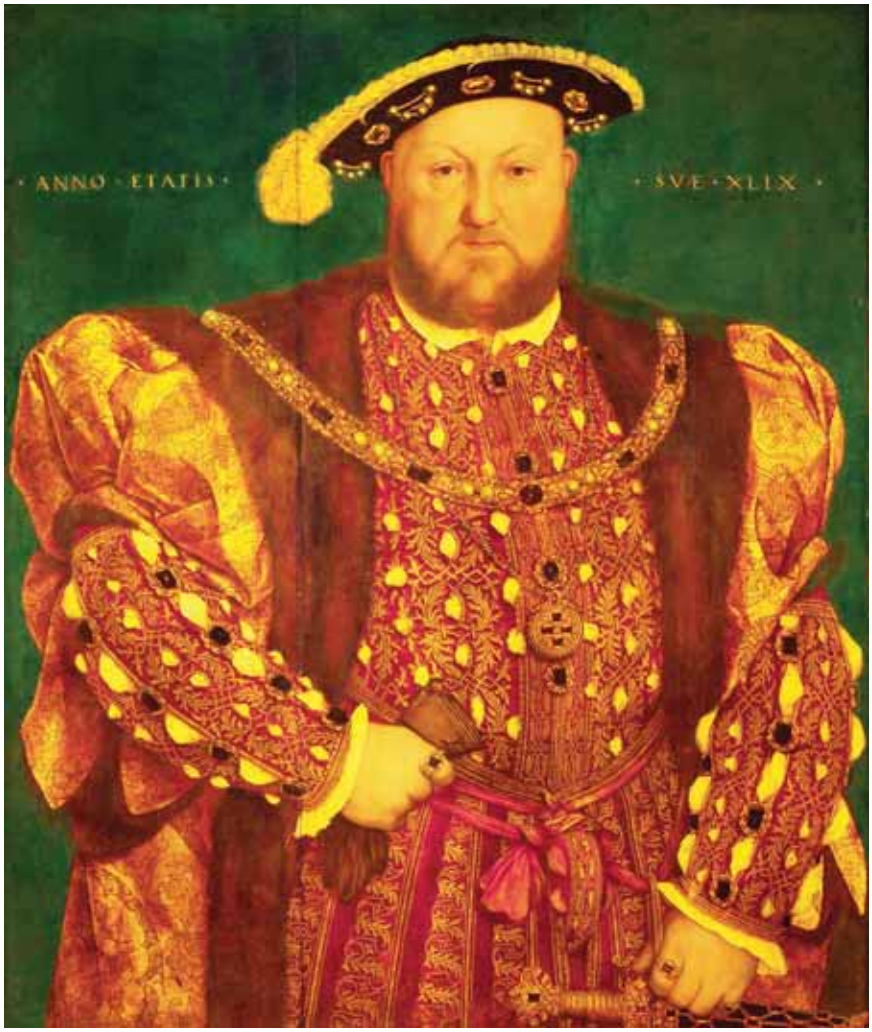


Figure 12. Hans Holbein the Younger, *Henry VIII,* AD 1540, Galleria nazionale d'arte antica. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor .org.source.unco.edu

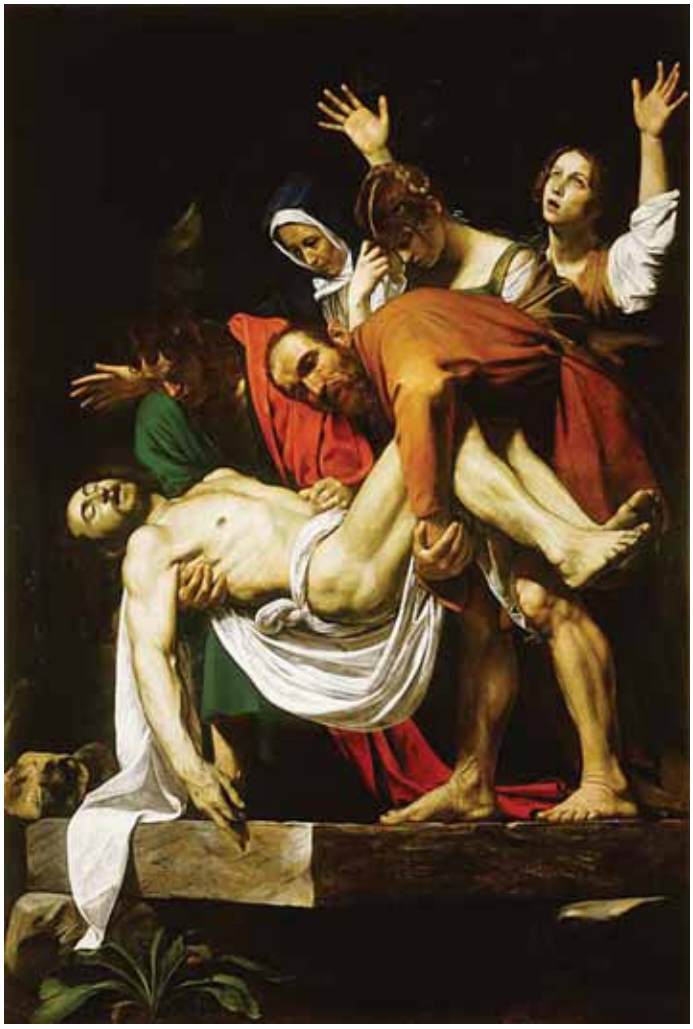


Figure 13. Caravaggio, *The Entombment,* AD 1602-1603, The Vatican. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 14. El Greco, *Saints John the Evangelist and Francis,* AD 1604, Galleria degli Uffizi. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor .org.source.unco.edu

Figure 15. El Greco, *Christ on the Cross Adored by Two Donors,* AD 1580, The Louvre, Paris. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 16. El Greco, *View of Toledo,* AD 1614, The Metropolitan Museum of Art, New York. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 17. El Greco, *The Holy Family with Mary Magdalen,* AD 1595, The Cleveland Museum of Art. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www .artstor.org.source.unco.edu

Figure 18. Pieter Claesz, *Still Life with Gilt Goblet,* AD 1635, Rijksmuseum, Amsterdam. Photograph by Peter A. White.

Figure 19. Peter Paul Rubens, *Prometheus Bound,* AD 1618, Philadelphia Museum of Art. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor .org.source.unco.edu

Figure 20. Jan Steen, *As the Old Ones Sing, So the Young Ones Pipe,* AD 1675, Philadelphia Museum of Art. From *ArtStor Digital Library,* by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 21. Casper David Friedrich, *Abbey in the Oak Forest,* AD 1809, Charlottenburg Castle, Berlin. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org.source.unco.edu

Figure 22. Casper David Friedrich, *The Polar Sea,* AD 1824, Hamburger Kunsthalle. From *ArtStor Digital Library*, by ArtStor, Inc., n.d., http://www.artstor.org .source.unco.edu