The History of Visual Technology

4th Edition

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Rev 2

UNIT 3

Workbook pages 87-124 only

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4th Edition

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NOTE

This is an extract of the full workbook, provided for the convenience of students enrolled in GPH-205 Historical Foundations of Visual Technology at DePaul University. This extract includes only the pages for the unit of the course identified on the cover.

The full workbook, in one .pdf file, is available for download at the course web site "startup" page. Students may use whichever version of the workbook download they wish as best suits their own learning purposes.

Visit the class web site at **http://gph205.info**

Viam sapientiae monstrabo tibi

Unit 3 – Renaissance and Reformation

Renaissance means "rebirth." What was reborn, starting in northern Italy about AD 1300, and lasting until about AD 1550? During this time Europe emerged from the "Dark Ages" in which much of the knowledge and artistic skill of the ancient world was rediscovered and extended. Artistry turned from telling religious stories in the simplest possible way to developing the tools and techniques to portray three dimensional things in the two dimensions of the painter's canvas. As Gombrich says at the start of chapter 17 of ***The Story of Art,*** the great Renaissance masters—Donatello, Da Vinci, Michaelangelo, and Raphael—produced three major accomplishments:

- the development of five scientific perspectives
- knowledge of human anatomy rivaling the knowledge of the ancient Greeks
- the rediscovery and resurrection of Greek and Roman architectural forms.

Coupled with the invention of oil as a binder for artistic paints, the accomplishments of the Renaissance set the stage for the art and philosophical thought for western civilization down to the present day.

The revolution in Western religious thought, the Reformation, was a rebirth of an earlier development. In the 1200 years since the adoption of Christianity by the Roman Empire under Emperor Constantine in AD 312, the church had grown into a large organization with massive wealth (much of it by donation of lands and money as legacies) with a vast hierarchy of officials leading up to the pope, the bishop of Rome. The church regarded itself as the interpreter of Christianity for its members. The bishops of the church, with the bishop of Rome as its head, was known as the ***majesterium***, claiming investiture by Christ through the apostle Peter as the gateway for man to God. This was challenged in the early 1500's in a revolt that had both religious and political dimensions. The result was that some areas of Europe broke away from the Church of Rome as protesters—"protestants." Protestants looked to the bible and Christ as the human connection with God. As we'll see, this split had consequences for art because the church had for over a thousand years been the largest commissioner of the creation of art.

Assigned reading and viewing

1. ***The Story of Art***, chapters 12 through 18
2. ***History of Visual Technology, 4th edition,*** Unit 3 (this chapter)
3. **Lecture and supplementary videos**; links provided on the unit web

Work due

1. **Unit Summary Form 3**
2. **Project 3** Exploring egg tempera, font and color use
3. *Extra credit:* Typography

GPH-205 Unit 3 Summary Form (USF3) Page 1

THIS IS BOTH A STUDY AID AND HOMEWORK ASSIGNMENT. Use a printed copy of this page for hand-written notes that you prepare as you accomplish the required reading and viewing. Put concise phrases in the boxes, not sentences! *Then download the editable .docx or .rtf copy of this form from the link on the course Unit 2 web page and type in your responses.* ***DO NOT COPY AND PASTE FROM TEXT OR WEB SOURCES.*** *The boxes for your responses on this form will automatically expand as necessary.* ***Submit your word-processed document NOT a scanned copy of your hand-written responses!*** *This work is integrated with your reflective essay and take-home final exam. The facts you gather form the basis for your essay and the Conclusions Work.*

Civilization/Art movement	Art purpose(s)	Art formation rules	Art technologies	Their art's impact on our modern life
Early Renaissance (up to 1400)				
Northern European Renaissance in the 1400's				
Tuscany and Rome in the 1500's				

GPH-205 Unit 3 Summary Form (USF3) Page 2

THIS IS BOTH A STUDY AID AND HOMEWORK ASSIGNMENT. Use a printed copy of this page for hand-written notes that you prepare as you accomplish the required reading and viewing. Put concise phrases in the boxes, not sentences! *Then download the editable .docx or .rtf copy of this form from the link on the course Unit 2 web page and type in your responses.* ***DO NOT COPY AND PASTE FROM TEXT OR WEB SOURCES.*** *The boxes for your responses on this form will automatically expand as necessary.* ***Submit your word-processed document NOT a scanned copy of your hand-written responses!*** *This work is integrated with your reflective essay and take-home final exam. The facts you gather form the basis for your essay and the Conclusions Work.*

Civilization/Art movement	Art purpose(s)	Art formation rules	Art technologies	Their art's impact on our modern life
Late Renaissance in Venice in the 1500's				
Northern Europe in the 1500's				
The Mannerist era				

A summary of perspective techniques

In art, ***perspective*** is synonymous with depicting depth. Paintings, sketches, printed illustrations and photographs are all two-dimensional objects. They have width and height but are essentially flat surfaces with no appreciable third "receding" dimension. Yet many artists want to depict things in such as way as to have our eyes "see" the third dimension. To accomplish this artists of the period immediately preceding the Renaissance, and during the Renaissance itself, began to experiment with techniques that would make it appear to the eye as if a two-dimensional depiction really did have the third dimension of depth. Here is summary of these techniques; ***you will find this summary very handy for Project 4 in the next unit!***

Positional perspective

Positional perspective is the simplest perspective technique but it's easy to overlook. It was the first technique of perspective that artists such as Giotto di Bondone (1267-1337) pioneered. This consists simply of conveying a sense of depth by placing some objects in front of others, allowing some parts of the object behind to be obscured by the object in front.

Light perspective

The technique of light perspective is also known as ***chiaroscuro***, the gradual shading of a circular or spherical surface when it is illuminated on one side by a light source. For example, the shading on a tennis ball in bright sunlight reveals its three dimensional shape to the eye: the sunlit side is brilliant and the ball shades gradually to the dark side. Artists of the Middle Ages had a idea of this, as seen in the shading of faces or objects in manuscript illuminations.

Linear perspective

The technique most commonly associated with producing the illusion of depth, an understanding of linear perspective was pioneered by Filippo Brunelleschi (1377- 1446) in the 1400s. Once you understand how linear perspective works, to prepare a drawing you draw lines receding to a point first, and then use them to map out the way that objects appear to gradually grow smaller in size in an orderly way as they become more distant. This seems simple to us now but it was revolutionary to artists of the Renaissance. See the next page for much more on this topic!

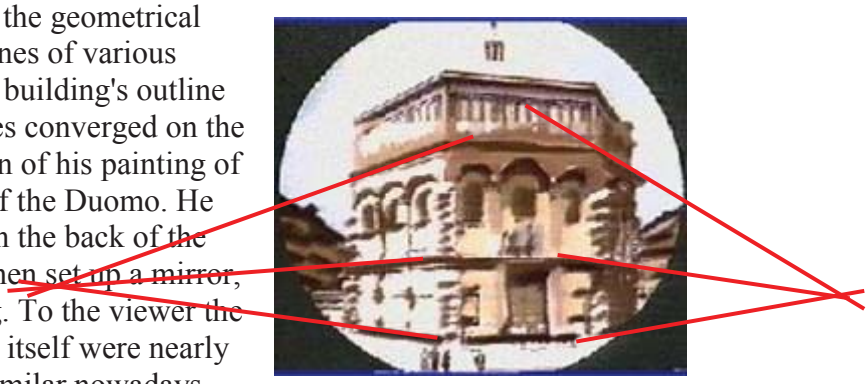
Atmospheric perspective

In outdoor scenes things in the distance appear to take on a bluish cast. The farther away they are the bluer they appear. This is due to the way the molecules and particles in the earth's atmosphere scatter the shorter (blue) wavelengths of light. This is also why the sky appears blue both on the surface of the Earth and when Earth is viewed from space. Technically this is known as Rayleigh scattering. An outdoor scene seems to have depth if the distant parts of the scene are pictured with a bluish cast since our eyes and minds are conditioned to this effect.

Focus perspective

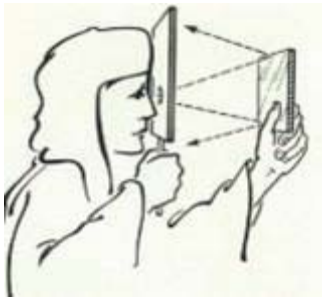
Objects closer to us appear with more detail than objects that are far away. If all parts of a scene are painted with a high degree of detail the painting looks "phony." To give a scene the illusion of depth a skillful artist will make objects in the distance a bit fuzzier. Don't confuse this though with ***sfumato***, and intentional bluring of some facial features close up, which is done for an entirely different purpose (to introduce uncertainty of emotion into a portrait).

Linear Perspective History and Use



In 1415 Filippo Brunelleschi demonstrated the geometrical method of perspective by painting the outlines of various Florentine buildings onto a mirror. When a building's outline was continued he noticed that all of the lines converged on the horizon line. He then set up a demonstration of his painting of the Baptistery in the incomplete doorway of the Duomo. He had the viewer look through a small hole on the back of the painting, facing the Baptistery. He would then set up a mirror, facing the viewer that reflected his painting. To the viewer the painting of the Baptistry and the Baptistery itself were nearly indistinguishable.[1] We can do something similar nowadays using a photograph of a scene.

Soon thereafter nearly every artist in Florence used geometrical (linear) perspective in their paintings. Donatello started sculpting elaborate checkerboard floors into the simple manger portrayed in the birth of Christ. Although hardly historically accurate these checkerboard floors obeyed the primary laws of linear perspective: all lines converged to a vanishing point and the rate at which the horizontal lines receded into the distance was graphically determined. This became an integral part of Quattrocento (1400's) Renaissance art. Not only was linear perspective a way of showing depth it was also a new method of composing a painting. Paintings began to show a single unified scene rather than a combination of several scenes.



To sum up: before this understanding of linear perspective artists simply did the best they could in picturing a scene in which distance was involved, such as a landscape. They composed their paintings according to rules of symmetry, rules dictating that the most important object be placed in the center or closer to the viewer than any other, and in "stock" ways with traditional poses more or less going by guesswork on how objects in the distance looked smaller. When linear perspective began to be understood an artist would first sketch a horizon line and vanishing point and lines converging to it and would then sketch in the placement of figures and objects sizing them according to the lines to the vanishing point. This would produce a more realistic-appearing composition. Quite often the effect was made explicit by including a floor composed of square tiles, a ceiling composed of tiles, or the rather artificial placement of long objects such as swords or spears pointing toward the vanishing point. Look at the fast-moving 2 minute animated video and you will see exactly how an artist who knows about linear perspective uses it to create an accurate sketch before applying paint to the scene.

[1] Images here are from: http://www.kap.pdx.edu/trow/winter01/perspective/ (accessed 2/1/2008)

Trompe l'oeil: illusions with linear perspective[1]

Trompe l'oeil (French for "trick the eye") is an art technique involving extremely realistic imagery in order to create the optical illusion that the depicted objects appear in three dimensions instead of actually being a two-dimensional painting. Here are some examples of trompe l'oeil artworks. At right is the oculus (hole in the center of a dome) on the ceiling of the Spouses Chamber in the castle of San Giorgio in Mantua, Italy, painted by Andrea Mantegna before AD 1500. It looks as if there actually is a hole here looking out to the sky and people looking in but it is really just painted on the center of the dome.

Here's another example, a before and after view of the Saint-Georges Theatre in Paris. You can see that the building has a bland wall with a few odd windows openings. The same building is pictured at the right with various architectural features just painted on. Yet especially at a glance the building looks as if those painted features are real! Trompe l'oeil type is always something of a practical joke.

A dramatic example of Baroque trompe l'oeil art at the lower right is a portion of the ceiling of Rome's Jesuit church of Sant'Ignazio painted by Andrea Pozzo between 1685–1694. This is Pozzo's masterpiece, with hundreds of figures that seem to be suspended in space in various poses of activity. A person sitting in this church is completely fooled by the expert use of linear, atmospheric and light perspective and the sense of depth is acute.

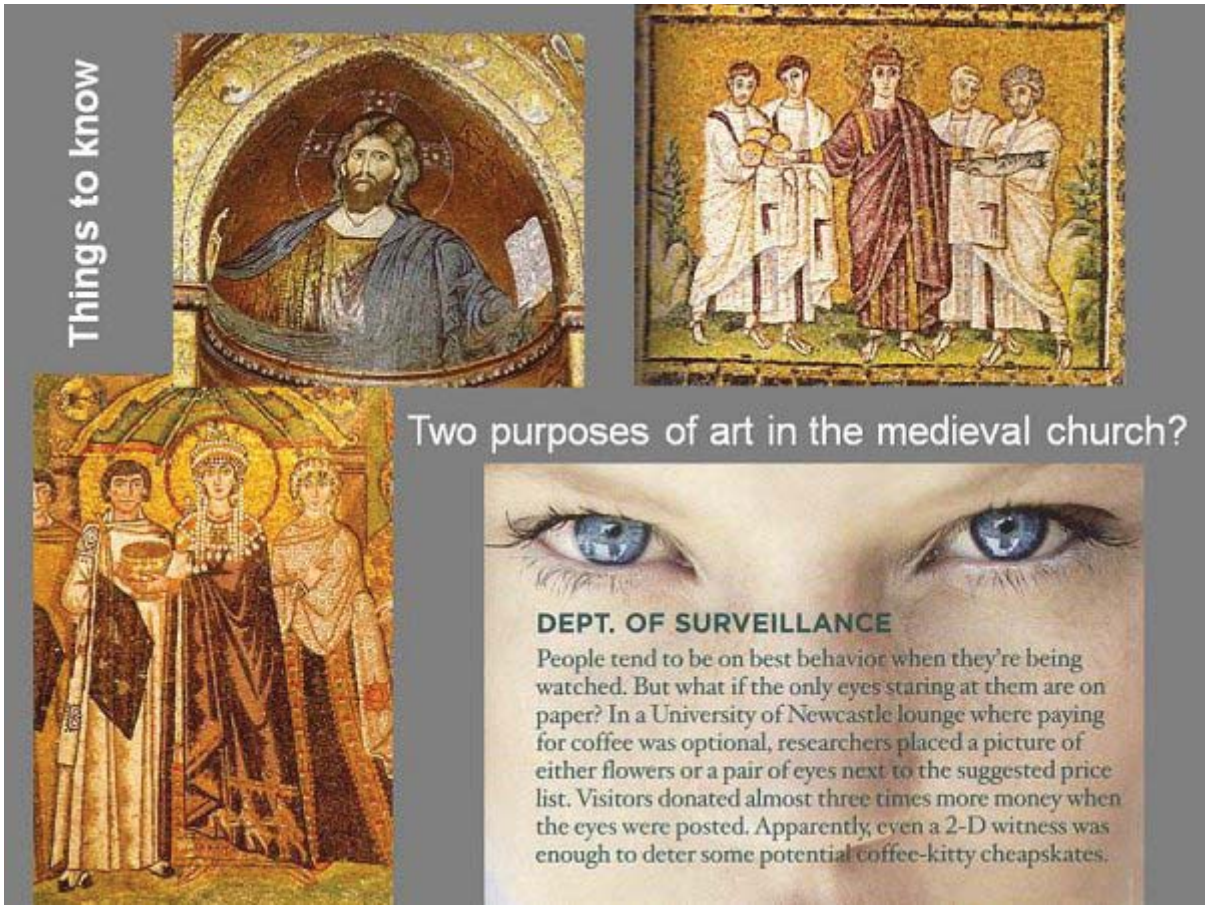
[1] This material was extracted from Wikipedia at http://en.wikipedia.org/wiki/Trompe-loeil. Find more information about the trompe l'oeil art of Andrea Pozzo at http://en.wikipedia.org/wiki/Andrea_Pozzo.

Julian Beever is an English artist famous for his trompe l'oeil sidewalk art created in chalk on pavements in England and around the world. Using chalk and a creative imagination Beever creates works that looks 3D only from the **correct position** using a projection called **anamorphism** that creates the illusion. Many people have speculated that his work as pictured on the internet is a result of digital photo editing but the images really are authentic street art. He projects an image onto the surface of the pavement at an oblique angle as a guide to drawing. Notice that phrase "correct position" in the paragraph above. As with a photograph, linear perspective can replicate what the eye sees. But unlike the real three dimensional world, a painting composed using linear perspective techniques (or a photograph) is locked into one perspective position. You can move around the painting or photograph and the view doesn't change as it would if you moved around a real three-dimensional object or scene. This doesn't matter much for a painting on a museum or church wall, but it does for a painting on a sidewalk where you can stand in front of, on the side, or behind it! The Beever flat pavement drawings here must be viewed from the position in which the linear perspective was composed or else the image is complete distortion.

The drawing of a globe at left looks fine from the correct position. But seen from the side, which is not the position from which the linear perspective was developed, the globe looks like it was made of dough and run over by a rolling pin! Beever also makes excellent use of light perspective (chiraroscuro) on the globe by making the top bright and the lower part shade off to darkness, enhancing the perception that the shape is round, and he puts a shadow under it.

Similarly, the picture below seems to look real as viewed in the photo on the left, but when you walk around it to view it from behind it makes no sense whatever—you can see that the pool has no depth and that the raised leg is really about 20 feet long. It is stretched out to give the same information to your eyes that a real leg would give if it were present and being viewed in front! See more of Beever's unique art at his web site, the link is on the unit web page for this page.

Who is watching and what does He see?



Examine the images and read the text above. Give it some thought. Are you "intimidated" or affected by someone looking at you? For myself, I have to say that it creeps me out to look at those eyeballs staring at me. These days the effect might even be heightened because we all know that video surveillance cameras are present in many stores and public locations so we may think that a picture with eyes like that is just a visual warning about the cameras—"someone is watching." But isn't that exactly the same as with many of the religious artworks and church decorations we have seen leading up to the Renaissance?

The next page is entitled "A thinking and discussion reading on perspective." You should become familiar with the notions expressed on that page, which is an extract from a writing by Christopher Small. That brief extract also deals with the way people look at things and how they think things should be observed.

In his writing Small gives a lucid description of several differences in orientation and outlook of people before and after the Renaissance and the effect of these differences on art. He proposes an explanation for the differences and how and why the thinking of artists changed. These are interesting and important ideas. You should be familiar with them and should consider drawing on these ideas as a resource in your reflective essay.

Why didn't perspective develop earlier?

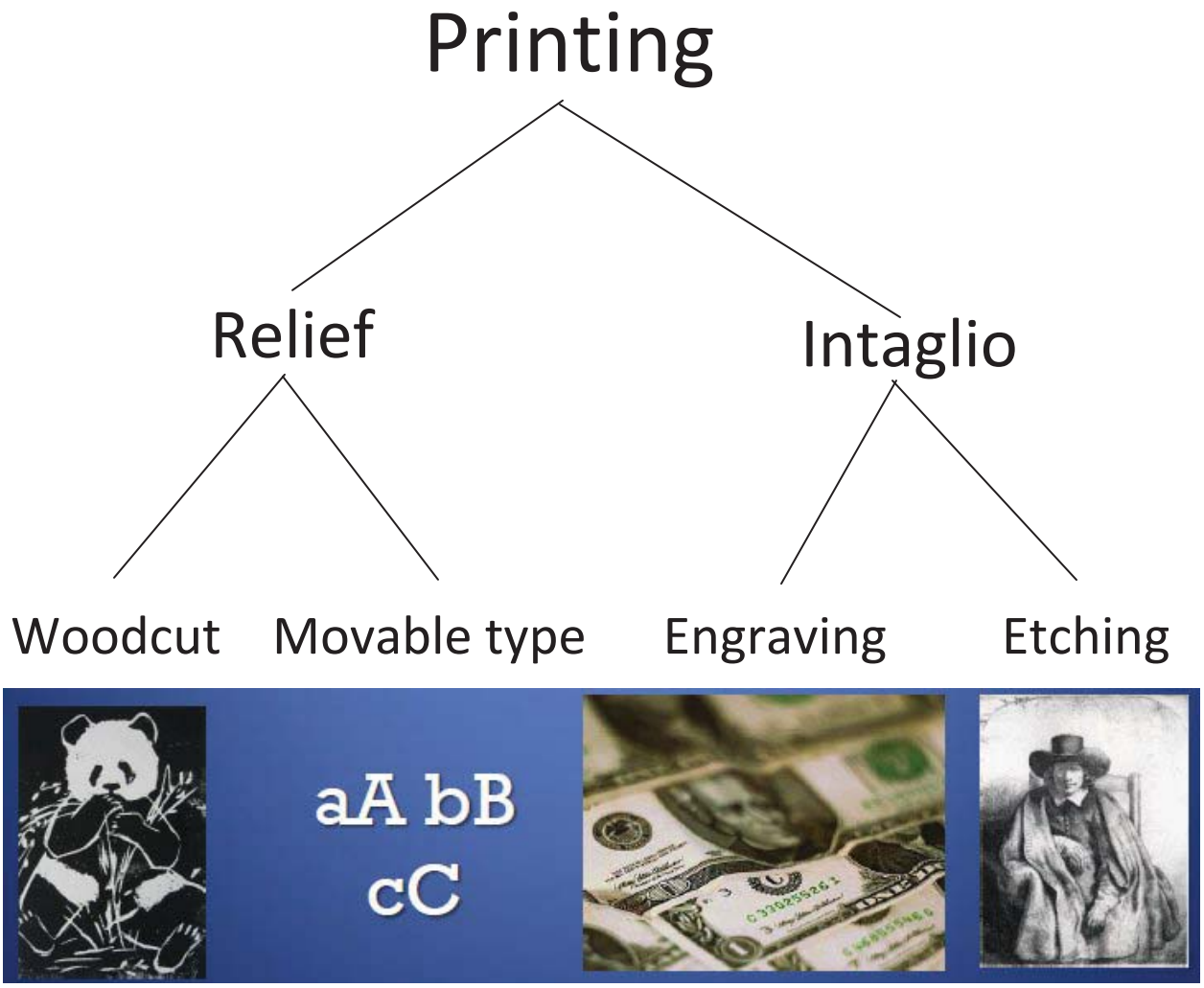
This reading is an excerpt from a book entitled ***Music, Society, Education*** by Christopher Small.[1] His book is a study of music as a social force; he reexamines assumptions about western classical music often taken for gradnted by people in modern society. In this excerpt from chapter 1 Small theorizes why the development of perspective did not occur earlier than the Renaissance. He summarizes his point of view about the differences in orientation between the medieval and Renaissance mind. Read this excerpt and see if Small's contentions parallel or differ from those of Gombrich in ***The Story of Art***.

> Europe in the centuries before the Renaissance was an oral, mainly non-literate communal culture, not so very different in style from the rest of the world. It was around the middle of the fifteenth century [1400s] that our culture began to reveal those new attitudes and concepts, ways of feeling, seeing and hearing, that were to cut Europe off from the rest of mankind and make her culture, including her music, unique.
>
> The changes are a familiar matter of history: the growth of humanism and individualism, the questioning of the theocentric world, and the desacralization of nature which gave rise to the scientific worldview, the "invention" of man as a private individual—the last possibly associated with the contemporary development of printing and the rise of the printed book. These changes became visible in painting as far back as Giotto in the thirteenth century [1200s], long before they became audible in music.
>
> **The medieval painter had seen his subject matter as it were under the eyes of God, who sees everything, to whom all events are simultaneous, and he gave expression to a communal, rather than a personal, consciousness.** Thus we might have a painting of a city in which all its features are depicted in a way which would be impossible for an individual standing in a single spot to see, but which might be said to represent God's view, as well as the whole community's experience, of the city. As long as painters took such an attitude perspective did not develop, not because painters were not capable of it but because it was of no use or interest to them as a technique. Similarly, we might see the representation of the life of a saint, in which his birth, several miracles, his martyrdom and his apotheosis are all contained within the single visual field. This can be taken as representing not only the combined vision of all who knew the saint, the communal experience, but also the divine, timeless, god's-eye-view of his life, in which all events are, not foreordained, but simply simultaneous. (The painter was so little concerned with the individual experience that the picture was usually unsigned.)
>
> **The post-Renaissance artist, on the other hand, saw his subject as if through the eye of a single spectator, in a particular spot at a particular instant.** Perspective, the placing of all the elements of a picture in logical relation to one another and to a "vanishing point", assumes that we look through the eyes of man rather than of God, the individual rather than the community, while **the instantaneousness of the painter's vision speaks of a concept of time very different from the medieval**. Man the individual, living in time, has displaced God, living in eternity, from the center of the universe.

[1] Small, Christopher (2011-02-15). Music, Society, Education (Music Culture) (Kindle Locations 351-354). Wesleyan University Press. Kindle Edition.

The four printing processes of the Renaissance

Two major types of printing were available to artists of the Renaissance period. Only the woodblock and intaglio processes were useful for the production of art. Here is how these processes naturally group according to the way they work.



Relief printing means that the surface is cut away for areas that are not intended to pick up ink and transfer it to paper—those areas are "relieved." The woodcut is prepared by an artist as a left-to-right reverse image by carving out the relief areas, inking the surface, and then pressing the block to paper. Movable type is usually cast in soft metal with the letter shapes raised.

Intaglio printing involves the relieved area carrying the ink to the paper. With engraving, score lines are scratched by hand in the flat surface of a metal plate. With etching, the metal is coated with wax and the wax scratched away so that acid can be used to eat away exposed metal forming ink-carrying lines. The ink in the score lines transfers to the paper when paper is pressing on the plate.

Fonts: different appearances for same letters

As Bruce Jones has written, *"In 1452, Johannes Gutenberg conceives of the idea of movable type. In his workshop, he brings together the technologies of paper, oil-based ink and the wine-making press to print books. The printing press is not a single invention. It is the aggregation in one place of technologies known for centuries before Gutenberg"*. Gutenberg's invention led to the possibility of standardization in the way the letters of the alphabet are formed. Prior to this time the style of script of manuscripts depended a great deal on the skill and hand of individual scribes or calligraphers. Letters themselves could be and often were regarded as artwork! The first "fonts" (families of letters in the same style) used by Gutenberg are now called "Blackletter" and look like the first line below:

Blackletter:

Old English:

Trajan:

Garamond:

Line 1 may seem hard to read! Font styles were progressively streamlined; the second line above shows an "old English" style and the third is a style derived from Latin inscriptions like those on Trajan's Column. The fourth line is close to the modern "Times Roman" font you are now reading. Arial, a sans-serif (without little "feet") font, looks like this with normal intensity or **like this** if "bold". Font size is measured in "points," with each point being 1/72 of an inch (in other words, 72 point type is one inch high).

The number of different fonts now numbers in the tens of thousands and new typefaces are still being designed. As Carlos Segura and others have pointed out, the appearance of a font can alter the intent of a message, and some fonts can in themselves represent works of art. Fonts available in modern word processing software on computers making fonts as varied as these and many others readily accessible:

Comic Sans Baskerville Old Face French Script **Bauhaus**

Printing processes used to produce artworks

Relief and intaglio printing processes flourished in parallel from the Renaissance onward. Let's consider some of the details and capabilities of each process.

Relief printing (block printing and movable wooden type)

Starting with a flat block of material, usually wood an inch thick, an artist carves away material to leave at the original surface level only the areas that are intended to print. A greasy oil-based ink is then rolled onto the raised surfaces then paper is pressed flat against the block with moderate pressure. The ink is thus transferred to the paper only where the block material was left uncarved. The image transferred to the paper is reversed from left to right from the original carving. Moderate detail is possible as in this German woodcut from the 1400s but not very fine lines because carving away as much material as is required for a fine line leaves the raised area too weak to survive much printing pressure. The woodblock can last for several hundred impressions but eventually begins to wear out at the finer (narrower) raised areas are crushed by the repeated printing pressure.

Intaglio printing (engraving and etching)

Intaglio printing processes include engraving and etching. In both of these processes grooves are formed in the surface of a flat metal plate. With engraving the lines are scored by an artist using a hand tool called a burin, a pointed rod of hard metal. With etching, the metal plate is first coated with wax and the artist scores lines in the wax, opening grooves that expose the surface of the metal. After all lines representing the image are scratched in the wax acid is poured onto the plate and eats away some of the metal exposed by the grooves (the wax is not affected by the acid). After the acid bath the plate is removed, washed and dried, and the wax is melted away. The effect of both engraving and etching is to produce a metal plate with lines that can "catch" and hold ink. To print, oil-based ink is rolled onto the plate then the plate is wiped with a flat absorbent surface. This leaves the ink only in the grooves. Paper is pressed with high pressure onto the plate. The parts of the paper over the grooves sink into them and pick up ink. Engraving and etching produce much finer lines than relief printing blocks, as you can see in this engraving by Israhel van Meckenam of him and his wife in the late 1400s. The shading is accomplished by carrying the width or spacing of the lines scored in the metal. The image is reversed left to right as in block printing. Engraving is used for fine artworks and documents such as paper currency that need to be difficult to copy. In addition to being capable of finer detail, intaglio printing plates can last much longer than relief woodcuts.

Additional printing processes

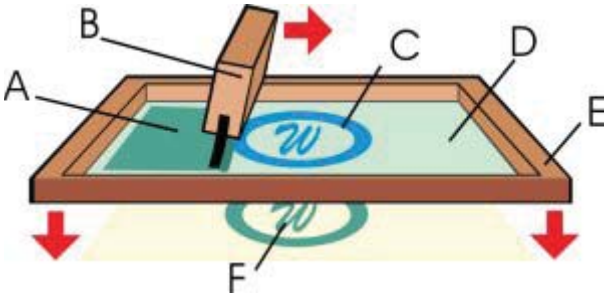
The relief and intaglio printing might be called "traditional" printing because they were in existence for hundreds of years before additional methods of printing were invented or popularized. In the 1800s additional methods of printing were developed or imported to the west.

Lithography

The lithographic printing process was developed in the 1800s and is very different than relief or intaglio printing. Here both the non-printing and printing surfaces are at the same level. This process is based on the natural repulsion of oil and water. The printing surface is a soft porous stone on which an artist draws using an oil-based substance. The stone is then dampened. Oil-based ink is applied to the entire surface but adheres only to the parts drawn on, not to the damp parts of the stone that have not drawn on. Paper is then pressed onto the stone with moderate pressure and the ink transfers to it from the parts that have been drawn on. This is how Ludwig Meidner created the lithograph here in 1918.

Silk screen printing

Screen printing is a form of stenciling that first appeared in a recognizable form in China during the Song Dynasty (AD 960–1279). It was then adapted by other Asian countries like Japan, and was furthered by creating newer methods. It was introduced to Western Europe from Asia sometime in the late 18th century, but did not gain large acceptance or use in Europe until silk mesh was more available for trade from the east and a profitable outlet for the medium discovered. In silk screen printing a fine mesh of silk (D) is stretched on a frame (E) and an artist either draws a reverse image (a negative, C) on the silk with an opaque paint or an image is formed on it using a photosensitive adhesive film and a strong light and the unexposed parts washed away. In either case the result is a mask in which the parts to print are clear silk and the parts not to print are coated with a layer impervious to ink. To print with the screen the frame is positioned on paper or cloth and ink (A) is applied to the silk and drawn across it with a squeegee (B). The frame is then lifted exposing the positive image (F). (Image courtesy Harry Wad and Wikipedia http://en.wikipedia.org/wiki/File:Silketrykk.svg)



Limitation of single-color printing

These processes are suited to printing in a single color. To produce a work in two or more colors the parts of the image to print in each color must be separated onto different woodcuts or plates. First one woodcut or plate is used to print a color, the printed material is dried, and then another woodcut or plate is used in a printing process to apply another color. The process of aligning the paper in each printing process) is error prone and many "impressions" can be ruined by misalignment (the upside down airplane on a stamp is a famous example).

Egg tempera painting[1]

Background: tempera in general

The art technique of tempera was known from the classical world and was the main medium used for illuminated manuscripts in the Byzantine world, Middle Ages, and early Renaissance Europe. Tempera painting was the primary panel painting medium for nearly every painter in Europe up to about 1500; for example, every surviving panel painting by Michelangelo was created using egg tempera.

Tempera is traditionally created by hand-grinding dry powdered pigments into a binding agent or medium, such as egg, glue, honey, water, milk (in the form of casein) and a variety of plant gums. Tempera painting starts with placing a small amount of the pigment paste onto a palette, dish or bowl and adding about an equal volume of the binder and mixing. Some pigments require slightly more binder, some require less. Distilled water may be added.

Oil paint replaced tempera as the principal medium used for creating artworks during the 1400s in the Netherlands. Around the year 1500 oil paint replaced tempera in Italy. In the 1800s and onward revivals of tempera technique have occurred in Western art among the Pre-Raphaelites, Social Realists, and others. Tempera painting continues to be used in Greece and Russia where it is the required medium for Orthodox icons.

Egg tempera

The most common form of classical tempera painting is **egg tempera**. Most often only the contents of the egg yolk is used: the membrane of the yolk is dangled over a receptacle and punctured to drain release the liquid inside. The paint mixture has to be constantly adjusted to maintain a balance between a "greasy" and "watery" consistency by adjusting the amount of water and yolk.

Pigments

Some of the pigments used by medieval painters, such as vermilion (made from cinnabar, a mercury ore), are highly toxic. Most artists today use modern synthetic pigments which are less toxic but have similar color properties to the older pigments. Even so, many modern pigments are still dangerous unless certain precautions are taken; these include keeping pigments wet in storage to avoid breathing their dust.

How it's applied

Egg tempera paint is usually applied in thin, semi-opaque or transparent layers and dries rapidly. Tempera painting allows for great precision when used with numerous small brush strokes applied in a cross-hatching technique. When dry it produces a smooth matte finish. Because it cannot be applied in thick layers as oil paints can, tempera paintings rarely have the deep color saturation that oil paintings can achieve. On the other hand, tempera colors do not change over time whereas oil paints darken, yellow, and become transparent with age. You can easily try egg tempera in a simple way by mixing egg yolk with any powdered pigment to make a thick paste, and applying the mixture to an index card using a q-tip as a simple brush.

[1] This material is extracted from `http://en.wikipedia.org/wiki/Tempera` and edited by Jim Janossy

Color technology advances in the Renaissance[1]

New pigments developed in Italy

Italians of the Middle Ages and Renaissance not only advanced art techniques but also introduced new pigments to the artist's palette. Their most important discovery was a method for extracting the brilliant blue pigment **ultramarine** from the blue mineral lapis lazuli, which contains about 10% ultramarine.

One method of extraction of ultramarine was to grind up the mineral into a fine powder and mix it with beeswax and resin. This waxy dough was kneaded in a bowl of water, releasing the blue pigment into the water while rocky grey minerals were retained in the wax. Kneading was repeated in several bowls of water to separate all of the ultramarine. The best quality of ultramarine with a bright, blue violet hue was released into the water first. Natural ultramarine was a highly prized pigment in Renaissance times and was often reserved for painting of the Virgin's mantle in religious scenes due to its high cost. The blue pigment had superior qualities, tinting strength and durability, and it continued to be the most expensive pigment until the advent of synthetically produced ultramarine.

Another pigment introduced by the Italians of the Renaissance was Naples yellow, a natural pigment found on the slopes of Mount Vesuvius. A method to manufacture it was developed about 1560. The pigment lead tin yellow, which can be prepared in a range of tones from lemon to deep yellow, was invented about this time.

Additional colored earth pigments were developed by the Italians during the Renaissance. The brown pigment umber is a mixture of iron and magnesium oxides, the name coming from the Italian “ombra” meaning shadow. **Umber** was used raw or was roasted to achieve a deep red-brown color known as **burnt umber**. **Sienna** was another natural earth pigment of yellow-brown color, composed of iron and manganese. Sienna could be used raw or after roasting in air to produce a dark brown color called **burnt sienna**.

Imported red pigments

Red was an expensive color to produce in medieval times and red clothes were an important status symbol, with the result that red dyes commanded high price. The Spanish conquest of the Mexican and Aztec civilizations of South America in the 1500s yielded the discovery of carminic acid produced by a female cochineal beetle, which produced a rich and long lasting red

[1] This writing draws much information from the multiple web-accessible references cited at in the index.

colorant. **Cochineal dye** was introduced into Europe in the late 1500s by Spanish explorers from South and Central America. Cochineal was imported into Europe in the form of the dried ground up insects. No information was provided on the source or nature of cochineal because the Spaniards closely protected their supply. In the colonial era cochineal was Mexico's second most valuable export after silver.

Dried cochineal looks like small silver-grey peppercorns or plant seeds. Before microscopes came into use European scientists argued as to whether cochineal was a plant, an animal or a mineral. Cochineal is actually a parasitic scale insect two to four millimeters in length that lives on prickly pear cactus plants (Opuntia or nopal) native to Central and South America. Scale insects are plant-sucking bugs that cover themselves with a fluffy white protective coating. The beetles are scraped from the flat leaves of cactus to harvest them, killed and dried. The cochineal beetle produces carminic acid as a by-product to deter predators. Crimson, fuchsia, raspberry and scarlet reds can be obtained from cochineal. The red colorant is used in drinks and in foods, under the code E120, and in drugs and cosmetics. It takes about 300,000 cochineal beetles to produce one pound of cochineal dye.

Cochineal is a traditional natural dye for coloring textiles in South and Central America and has been used for beautiful, lightfast and permanent scarlets, pinks and reds. Cochineal has been used in Peru for about 1500 years and in Mexico for 1200 years. Commercial production cochineal in Mexico collapsed in the late 1800s but Peru remains an important producer and accounts for 85-90% of world production. Several other countries, including Chile, Botswana and the Canary islands, also cultivate cochineal and are together responsible for the remaining 10-15% of production.

Cochineal produced a deeper and longer lasting red than madder; the distinctive redcoats of the British Army were dyed with cochineal. Cochineal quickly superseded kermes for reds because of its wider availability and stronger color. In the nineteenth century, when artificial dyes were developed, the production of cochineal declined markedly; red became very cheap to produce and was no longer valued.

Cochineal was widely used to manufacture lake pigments, some of which are still employed today. Since it is entirely organic in nature and safe to consume in foodstuffs, it's still used in cosmetics such as lipstick and nail varnish. Until recently it was used by the Starbucks chain to color some coffees.

Polish cochineal, Kermes, Lac and St John's Blood are produced from different scale insects that are related to cochineal insects. None of these produces as deep red a color as cochineal, which is why cochineal was so prized as a colorant.

Indian lac and Brazil wood

Indian lac was another red pigment of organic origin obtained from a female insect (Coccus lacca), native to India. The female lac insects spend their entire lives clustered together in large groups on trees, and when the lac was harvested sticks were simply cut down from the trees with the insects still attached. Stick lac appears more like some type of growth on the tree than a group of living insects and this led to some confusion over the origins of lac. After harvesting, the dead insects were stripped from the sticks, crushed and mixed with hot water to separate the dye. When the water was evaporated the red pigment that remained was formed into cakes ready for use by painters. Indian lac is crimson in color.

Brazil wood is a colorant produced from the wood of the Caesalpinia tree native to the East Indies and South America. It's a red pink color. The dye is made by grinding brazil wood into small chips then boiling these in a mixture of water and vinegar. Alum power is used to make the pigment coagulate out of the liquid. Brazil was a popular pigment but gradually fell out of favor because, like many natural plant-derived pigments, it tends to fade.

The Renaissance in Northern Europe

Even in the 1400s painters prepared their own paints and often made their own pigments with the help of apprentices in the workshop. They would often experiment with new ideas in much the same way a scientist would in the laboratory. Jan van Eyck (1390-1441) found the medium of egg tempera to be too restrictive for his purposes so he began to experiment with new binders; he came across the idea of using oil as a binder thus creating **oil paint**. This new style form of paint was quickly accepted by Van Eyck's contemporaries and gained popular acceptance throughout the artistic community in the North of Europe and eventually in Italy.

Oil paints were made by grinding pigments in linseed oil to form a smooth, stiff paste, which could be applied to a canvas stretched across a wooden frame. The oil paints were versatile and slow drying and could be applied in many layers with stiff brushes or palette knives. The paints could be applied as opaque layers or in glossy transparent "glazes" to provide a wide range of visual effects.[2] Van Eyck skillfully blended a limited number of basic pigments in his work to mix colors as paints and (using the glazing technique) on the canvas as light filters to create bright, colorful paintings. One of the palettes he used in the early 1400s has been analyzed and contains just eight pigments: brown earth, red madder, ultramarine, yellow ochre, green earth, orpiment, red ochre and peach stone black.

The High Renaissance

In 15th century Italy, the mediums of egg tempera and fresco were still very much in favor, and artists, having tackled the problems of perspective, began to explore light and shadows and the composition of their paintings. Representing realistic figures in perspective against a background was difficult and many early attempts were clumsy. But the master of the Renaissance, including

[2] In art, "glaze" has two meanings. The earliest meaning identifies a watery compound applied to once-fired pottery, which is then fired a second time to bind the glaze to the pottery and set its final color. As applied to oil painting, the term "glaze" means a thin transparent coating of oil paint or shellac or varnish applied to a painting.

Da Vinci, Michelangelo, and Rafael produced some of the greatest works of art such as the Mona Lisa and the frescos of the Sistine Chapel during this time. These have influenced our interpretation of religious events and painting styles ever since. Artists in this period became famous in their own right and were elevated above their traditional status as craftsmen.

Northern Europe

Watercolors are dried blocks of paint produced to be easily dispersible in water. The pigment was mixed in some type of binder, traditionally gum Arabic. The water was subsequently evaporated to give dry tablets of paint that could be readily redispersed and applied to the painting surface. Watercolor did not gain widespread popularity until the eighteenth century but was often used in the Netherlands from the time of Dürer onward.

The Reformation

A serious crisis was faced by the painters of Northern Europe as a result of the religious reformation of Martin Luther, which caused huge upheaval throughout many countries from 1517 onward into the next century. Spain, France and Italy supported the Catholic Church while England, the Netherlands and Germany became Protestant. With the Reformation came a great decline in the demand for artwork because Protestants regarded much of the religious artwork as idolatrous. Since the vast majority of commissions for artists had come from the creation of altar pieces for churches and cathedrals, a large source of income for artists was suddenly cut off. Two solutions to this problem arose. Artists such as Peter Paul Rubens (1577-1640) and his apprentice Anthony Van Dyke (1599-1641) painted vibrant living portraits that often defined moments of history during these hectic times. And the genre of still life painting was popularized, using subject matter that would not offend the Protestant church but would be attractive enough for a wealthy merchant to purchase for home decoration.

New pigments beyond the Renaissance

From the Renaissance to the 17th century a few technical discoveries were made in pigments such as Vandyke brown, a dark brown, transparent color extracted from lignin or peat deposits. Two yellow pigments were introduced to Europe from the East around 1600. One of these was **gamboge**, an organic pigment made from the gum of the Garcinia evergreen tree. The trees were tapped by making incisions in the bark to let the gum drip out; the gum was then heated and run into hollow bamboo tubes where it was left to set. Gamboge was used as a watercolor pigment and was something of a novelty, being both a pigment and a binder combined into one.

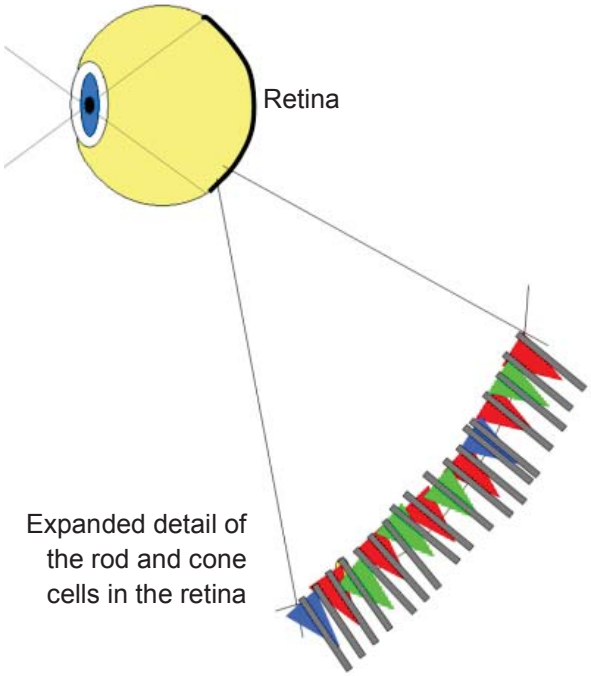
Indian yellow was another yellow pigment imported from the East. Due to its fluorescence it was especially vivid and bright in sunlight. Chemist John Stenhouse examined Indian yellow colorant balls imported from India in 1844 and reported that they were composed of gallstones from camels, elephants, or buffalos, or deposited from the urine of some of these animals, or possibly of vegetable origin. Stories persist that Indian yellow was made by feeding cows mango leaves, which caused their urine to become bright yellow. The urine was collected and heated to precipitate the yellow colorant, which was then separated and formed into lumps for sale. Little evidence has been found confirming the mango cow diet process.

Both of these yellow pigments were widely used by artists before they were replaced in the 1900s by more reliable synthetic colorants.

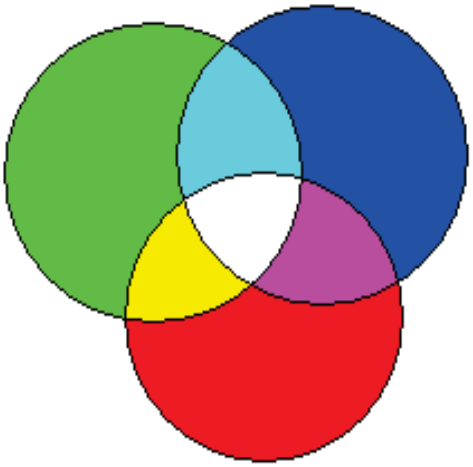
Why we see color: light and paint color mixing

Do colors really exist? How do our eyes see color? Do we see colors the same as animals and insects do? And do two people really see the same color the same way? Let's lay the basis for answering these questions. Let's start with the human eye.

The eye is like a camera in that it has a lens that focuses an image on a surface. But it is also a transducer that generates electrical signals based on the light falling on the surface on which the image is focused. That surface, called the retina, is composed of four types of cells. One type of cell (rod cell) is sensitive to light intensity and sees all colors—in other words, it forms black and white images. It is more sensitive than the other cells (cone cells), which are each sensitive to light of red, green, or blue colors only. When the light level is low you see only in black and white because the rod cells can detect the light but the color-sensitive cells cannot. The cells are very small, from 1 to 5.5 µm (micrometers, also called micron; 1,000 microns = 1 millimeter). To give you some sense of this cell size compare this to a human hair, which is typically between 50 to 120 microns in diameter. The cells are very tiny.



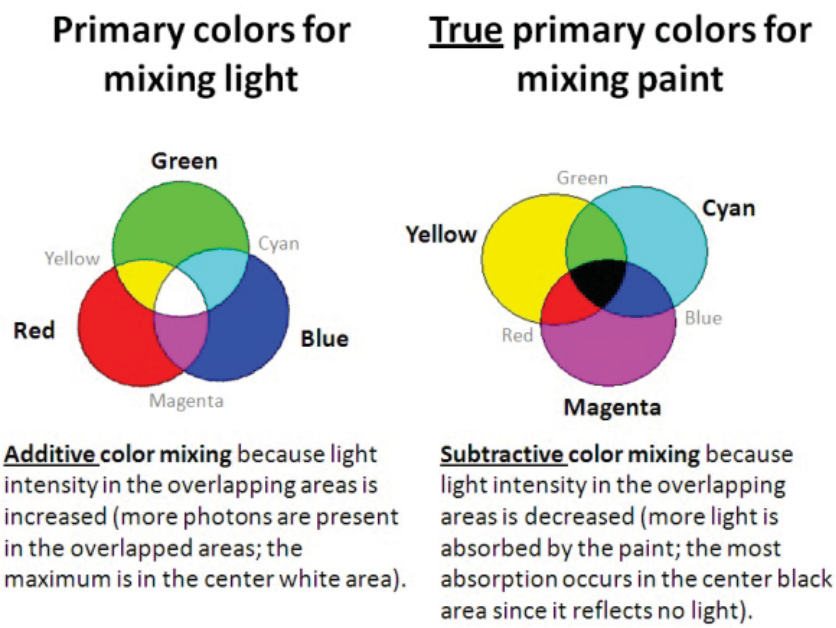
The fact that the cone cells in the human eye are sensitive to red, green, and blue light should give us something to think about in connection with colors, because after all, we can see a lot more colors than just those three! And in fact it is the key to many technologies involving color such as color photography, color television, computers, and color printing. Here is the crucial point to understand: to the human eye, all colors can be represented by the combination of these three colors: red, green, and blue. View the first video in the playlist for this page and see why this is possible (the link is on the Unit 3 web page).



If we overlap light beams from red, blue, and green light sources the light mixes In the overlapped areas the light intensity is increased and the mixing of the light produces colors named cyan, magenta, and yellow. Now let's take a closer look at this light mixing phenomenon and how it compares to the mixing of paint and color printing.

Here is an illustration showing you the colors produced when light is mixed, and when paint is mixed. Notice **three things** about this illustration:

1. **The "primary" colors for paint mixing are NOT what you have probably been taught** (we'll explore why that is).
2. **Light mixing and paint mixing actually directly complement one another**: they work as opposites starting with and producing the same colors.
3. **Mixing all of the primary colors of light produces white; mixing all of the true primary colors for paint produces black.**



Facts 2 and 3 are the kind of logical symmetry that many scientists feel permeates all of the laws that govern the universe. But you don't believe me on the first point above about primary paint colors? Watch the second video in the playlist for this page in which Jared Bendis demonstrates true primary paint mixing. He shows you how the paint colors historically thought to be the primaries (red, yellow, and blue) are just an approximation and came to be regarded as the primaries only because it was possible to obtain them from animal, plant or mineral sources.

Differences in the way the color-sensing cells work in the eyes of different people will affect the way they perceive color. The most extreme example is with color-blind people. If the red-sensing, or green-sensing, or blue sensing cells in a person's eye are damaged or deficient, that person will see colors entirely differently than other people do.

But why do different objects appear to us to be different colors? Sunlight appears white because it contains energy across the entire electromagnetic spectrum. Our eyes are sensitive to a very confined "slice" of this energy, which account for all of the color sensations our eyes can detect and our brains turn into our perception of color. The surface of a given object absorbs some the energy and reflects some of the energy. We see what the object reflects. So for example a banana absorbs the visible energy for all colors except yellow, which it reflects; we see the banana as yellow. Watch the third video in the playlist for this page, the link is on the web page for Unit 3 at the course web site!

Introduction to Color Theory[1]

Color theory in the visual arts is a body of practical guidance for color mixing and the visual impact of specific color combinations. Categories of colors are based on a color wheel: primary color, secondary color and tertiary color. Although color theory principles first appeared in the 1400s in the writings of Leone Battista Alberti and the notebooks of Leonardo da Vinci a tradition of actual color theory began only in the 1700s with Newton's theory of color and the nature of so-called primary colors.

The foundation of pre-20th-century color theory was the idea of "pure" or ideal colors, characterized by sensory experiences rather than attributes of the physical world. This has led to a number of inaccuracies in traditional color theory principles. The most important problem has been a source of confusion between the behavior of light mixtures, called **additive color mixing**, and the behavior of paint or ink or dye or pigment mixtures, called **subtractive color mixing**. This problem arises because the absorption of light by material substances follows different rules from the perception of light by the eye. What is being “added” or “subtracted” is light intensity. In both pigment mixing and might mixing, something is being added to something else in the colloquial sense, namely pigments or lights of different color. But when light is added to light the intensity increases. When pigment is added to pigment, with each absorbing different colors, the intensity of the reflected light diminishes from that reflected by either pigment alone.

A second problem has been the failure to describe the very important effects of strong luminance (lightness) contrasts in the appearance of colors reflected from a surface, such as paints or inks, as opposed to colors of light. Colors such as browns or ochres cannot appear in mixtures of light. Thus, a strong lightness contrast between a mid-valued yellow paint and a surrounding bright white makes the yellow appear to be green or brown, while a strong brightness contrast between a rainbow and the surrounding sky makes the yellow in a rainbow appear to be a fainter yellow, or white. Most color effects are due to contrasts of three attributes that define all colors:

- Lightness (light vs. dark, or white vs. black)
- Saturation (intense vs. dull)
- Hue (e.g., red, orange, yellow, green, blue or purple).

For example, the visual impact of "yellow" vs. "blue" hues depends on the relative lightness and intensity of the hues.

These confusions arose in scientific uncertainty about color perception that was not resolved until the late 1800s when artistic notions were already entrenched. Many historical "color theorists" assumed that three "pure" primary colors can be mixed to produce all possible colors and that any failure of specific paints or inks to match this ideal performance is due to the impurity or imperfection of the colorants. In reality any three real "primary" colors of light, paint or ink can mix only a limited range of perceived colors, fewer colors than the full range of colors human eyes can perceive.

Color theory was originally formulated in terms of three "primary" or "primitive" colors—red, yellow and blue (RYB)—because these colors were believed capable of mixing all other colors. This color mixing behavior had long been known to printers, dyers and painters, but these trades

[1] This material was extracted from http://en.wikipedia.org/wiki/Color_theory and heavily edited to suit it to the intended readership of this workbook ☺ Jim Janossy.

preferred pure pigments to primary color mixtures, because the mixtures were too dull. For example, a real purple dye or paint was preferable to a mixture of red and blue paint.

The red, yellow and blue primary pigment colors became the foundation of 18th century theories of color vision. These theories were enhanced by investigations of a variety of purely psychological color effects, in particular the contrast between "complementary" or opposing hues that are produced by color afterimages and in contrasting shadows in colored light. These ideas and many personal color observations were summarized in two early works in color theory: the ***Theory of Colors*** (1810) by the German poet Johann Wolfgang von Goethe, and ***The Law of Simultaneous Color Contrast*** (1839) by the French industrial chemist Michel Eugène Chevreul.

German and English scientists established in the late 1800s that color perception is best described in terms of a different set of primary colors—red, green and blue violet (RGB). Subsequent research anchored these primary colors in the differing responses to light by three types of color receptors in the retina of the human eye. Concurrently, industrial organic chemistry radically expanded the color range of lightfast synthetic pigments, providing improved saturation in color mixtures of dyes, paints and inks. Three-color printing to produce a full range of perceived colors became economically feasible in mass printed media when the artists' “historical” primary pigment colors were abandoned for the “scientific” primary pigment colors cyan, magenta, and yellow. These “scientific” primary pigment colors each absorb only one of the retinal primary colors: cyan absorbs only red, magenta absorbs only green, and yellow absorbs only blue violet. By mixing the scientific primary colors very nearly all secondary and other colors can be produced more accurately and in higher saturation than with mixtures of red, blue, and yellow pigments.

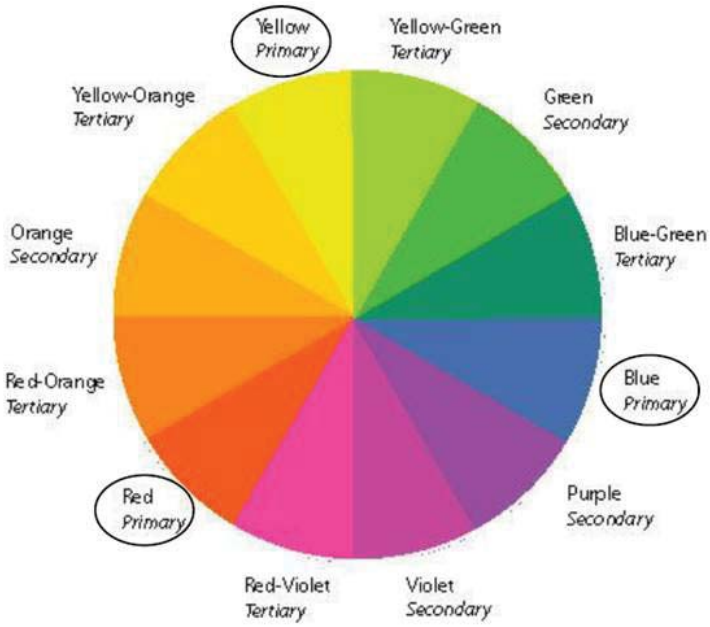
What follows is a simple summary of color theory terms and concepts sufficient to inform the discussion of art technology in parallel with the time period coverage of last half of ***The Story of Art*** by Ernst Gombrich.

Introduction to **Color Theory and Definitions**

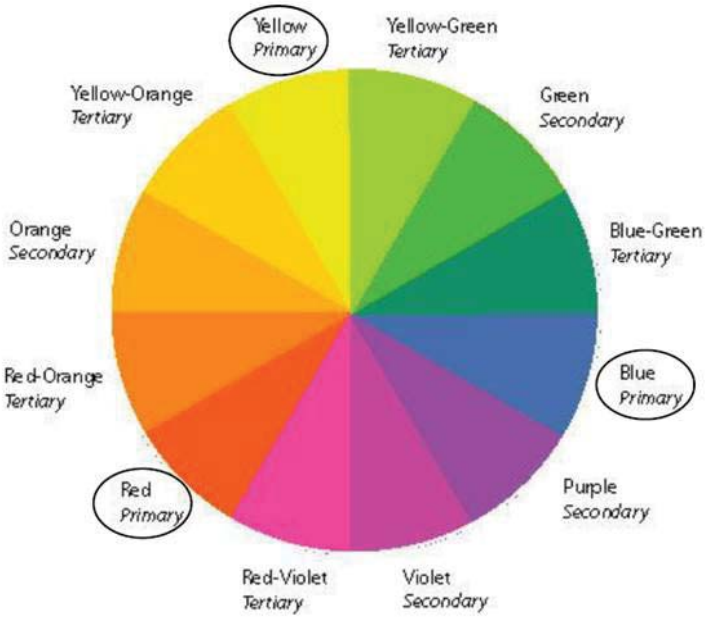
This material on color theory was originally developed under a grant by Bloomsburg University, Lock Haven University, Mansfield University, Millersville University and Shippensburg University in 2001. I have extracted 10 “lessons” from that work and arranged them in this sequence for presentation here:

Topic 1 – Hue
Topic 2 – Shades
Topic 3 – Tints
Topic 4 – Warm and cool colors
Topic 5 – Analogous colors
Topic 6 – Complementary colors
Topic 7 – Monochromatic colors
Topic 8 – Triadic colors
Topic 9 – Colors that move
Topic 10 – Color combinations to avoid

Keep in mind that the color wheel referred to by the authors of this material looks like this and relies on the **historical** definition of pigment color mixing that defines red, yellow, and blue as the primary colors. **You already know that these historical primaries are not quite accurate: the actual subtractive primary colors are magenta, yellow, and cyan.** The historical color wheel looks like this example.



When you read this these materials and they refer to "opposite" or "adjacent" colors or colors 120 degrees apart they are relying on this color wheel. The colors midway between the **primaries** here ("**secondary**") are what you get if you mix equal parts of the pigment primaries. The colors to the left and right of those mixtures ("**tertiary**") are what you get if you mix primaries in different proportions.

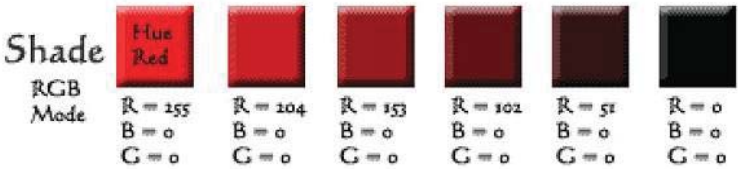


Topic 1: What is a hue?

Each individual color in the color wheel is a hue. **Hue** is the name of the color, for instance red, green, navy blue, orange, purple, lavender, turquoise. Hue is absolutely any color in the rainbow that you choose to pick. When you open a brand new box of Crayola crayons and read the name on the wrapper of each color, you are reading the hue. It doesn't matter if it is red, maroon, a shade of red, or pink, each one of those names is a hue. Unlike "color" hue has no other meaning, it is never a verb.

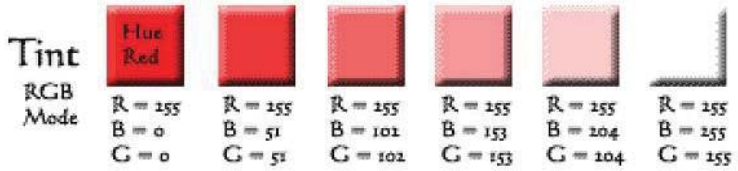
Topic 2: What is a shade?

The terms *value* and *brightness* refer to the light or dark qualities of a color. The **shades** (dark colors) are low values. Below, the hue red is shaded in RGB (red, green, blue intensity values) as coded for the web. As you move from left to right in the RGB light mixing (additive) color palette you create each shade of red by decreasing the amount of red and therefore decreasing the amount of light. In working with pigments (subtractive mixing) you progressively add black to red to create darker and darker shades of red.



Topic 3: What is a tint?

The terms *value* and *brightness* refer to the light or dark qualities of a color. The **tints** (light colors) are high values. Below, the hue red is tinted RGB mode. As you move from left to right in an RGB light mixing (additive) color palette you create each tint of red by keeping the same amount of red light and increasing the amount of both blue and green light. In working with pigments (subtractive mixing), you add more and more white to red to produce lighter and lighter tints of red.



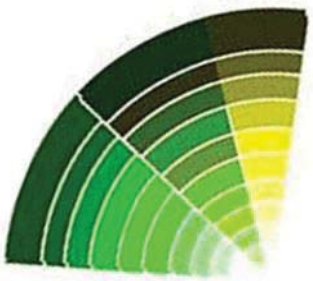
Topic 4: Warm and cool colors

Warm colors are vivid in nature. They are bold and energetic. Warm colors are those that tend to advance in space (come forward); therefore, caution needs to be taken so you do not overwhelm your content with eye catching hues. If an element in your design needs to pop out, consider using warm colors to do that.

Cool colors are soothing in nature. They give an impression of calm and rarely overpower the main content or message of a design. Cool colors tend to recede; therefore, if some element of your design needs to be in the background, give it cool tones.

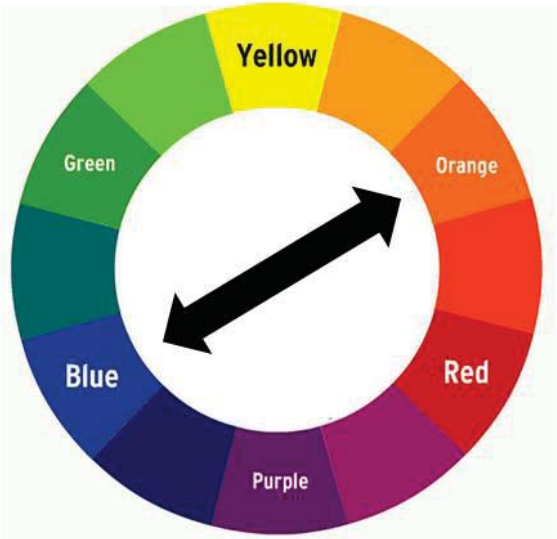
Topic 5: Analogous colors

Analogous colors are a palette of compatible color combinations that blend well together. They are ***neighbors*** on the color wheel. They tend to live harmoniously because they are relatives to each other. Analogous colors are less vivid, bright and saturated. They have less contrast and vibrational energy then complementary colors. Here's how artist Owen Demers explains analogous colors: "Think of purple, blue, and, magenta colors in a twilight sky or the yellows, golds, and oranges in an Arizona desert. A pine forest has light greens to blues and purples within its depths."



Topic 6: Complementary colors

Complementary colors are colors that are ***opposite*** each other on the color wheel. They contrast, enhance and intensify each other. Therefore, complementary colors need to be used with caution. The differences in tone and hue can be eye catching, but used to much they can be an eyesore. terms

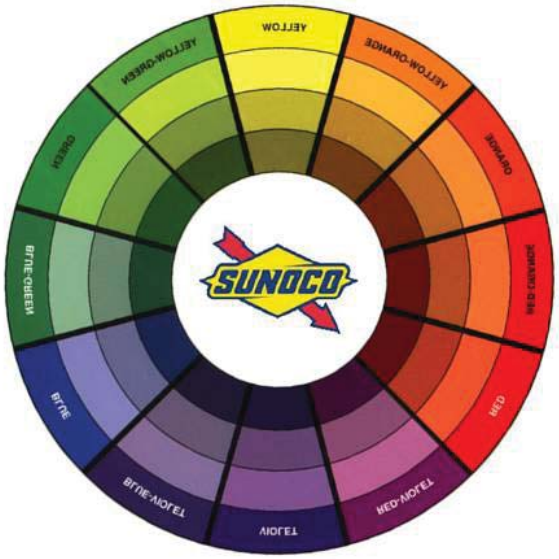


Topic 7: Monochromatic colors

Monochromatic colors are ***all the tints and shades of a single color***. As a result, the energy is more subtle and peaceful due to a lack of color contrast. Monochromatic colors offer very little contrast and may be considered boring unless there is diversity within the design.

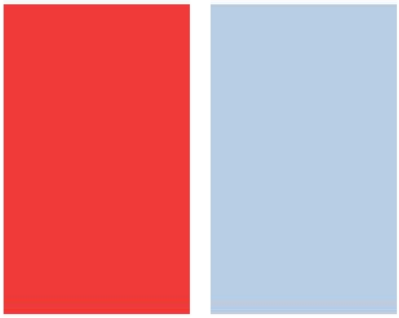
Topic 8: Triadic colors

Triadic colors are high-energy colors that are ***separated by 120 degrees*** on the color wheel. The primary (red, blue, and yellow) and secondary (purple, orange, green) colors are examples of triadic colors. Use triadic color choices when you want to make an image stand out even almost to the point of being too vivid. The Sunoco brand trademark is a good example of triadic color use.



Topic 9: Colors that move

Bright, high-intensity, warm colors advance in space—that is, they tend to look closer than the surface they are displayed on. They appear as though they are going to jump out at you. They get your attention. Low intensity, cool colors, on the other hand, recede; they make a space appear larger than it is by appearing to fade farther away. By combining these colors you can create the appearance of dimension or depth to a picture that's actually on a flat sheet or canvas.

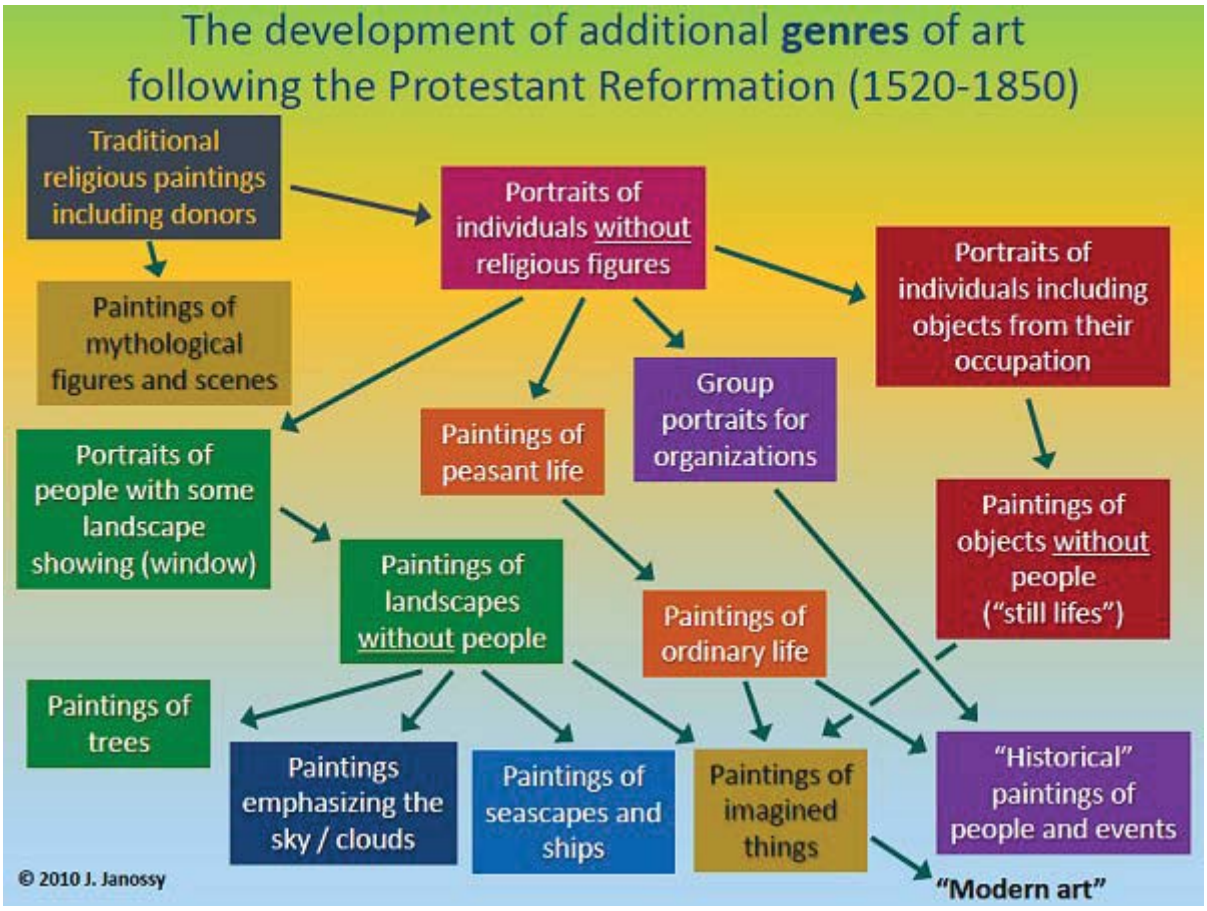


Topic 10: Color combinations to avoid

What are some color combinations that should be avoided? Many people feel that primary colors go together. And indeed, there are many times when these combinations have been used successfully, especially with children's toys. But when viewed on the computer, it can be another story. A web site design that uses too many bright primary colors can actually be painful to look at! Similarly, screens with too little contrast between text and background can be hard to read.

This lettering in blue can be hard to read against a dark background.

The development of genres of art



As your explorations in ***The Story of Art*** have revealed, the subject matter deemed worthy of depiction in painting was different in different civilizations. In western civilization during the Middle Ages and through the Renaissance by far the most prevalent subject matter was holy figures and sacred events, although figures and scenes from classical Greek and Roman mythological became popular during the Renaissance. But starting with the Protestant Reformation in 1517 the use of art to decorate churches fell into great decline in areas that broke away from the Roman church and adopted one of the denominations of Protestantism. You can trace the progression of subject matter development from that point onward by following the arrows from the box at the upper left.

A common practice in religious art commissioned by a private party and donated to a church was the inclusion of the image of the person—the donor—in the artwork. Portraits can be thought of as almost the same thing, except that only the donor is depicted, not a holy personage or scene. It became common to include in the portrait various implements of the person's business or trade, leading to objects being included in the portrait. At some point artists realized that the objects themselves could be painted in interesting ways without a person present, and "still life" painting began. Still life subject matter let an artist demonstrate his or her skill in painting difficult things, such as a glass container partly filled with water. A final step in that progression was the realization that an artist could paint things he or she only imagined, which never existed at all.

Project 3

A multi-part, hands-on project designed to make many of the highlights of art technology of the Renaissance **REAL** to you!

This project has **three required parts**:

1. Exploring pigments and lakes with egg tempera

2a. Exploring font use in commercial design

2b. Exploring color use in commercial design

In addition, an optional extra credit item is available to you: adding visual meaning through font use.

I have carefully designed and documented the parts of this project so that each part should be easy to follow. Each of the parts is equipped with one or more web resources such as brief readings or tutorial videos. You can submit the different parts of this project separately; there's no need to hold onto the separate parts to submit them all at once. Contact me if you have any questions or problems! ☺ Jim

Project 3

Exploring Paints, Fonts, and Color Use

Part 1 of 2: Exploring egg tempera paint

In the Middle Ages and the Renaissance egg-tempera paints and lakes were often used to create paintings. In this project you'll explore how to make egg tempera paint, how to create a lake pigment and use it with egg tempera, and will experience how these work and "feel" as paints.

Definitions

Egg-tempera paint consists of a pigment and egg yolk as a binder. Egg tempera paints dry quickly and must be made up in small batches and used within a few hours. The pigment for egg-tempera paint can consist of any substance ground up to form a fine powder.

A **lake** is a form of pigment. It consists of a powder made of crushed bone, chalk, or ground eggshells that you can think of as being "dyed" using a textile dye. A **dye** is a watery solution useful for coloring cloth. A dye can't be used directly as paint because it's too thin. You can make a dye by drying, cutting up, and boiling the roots of some plants or by drying and grinding up certain insects or shellfish. When you use a dye to color crushed bone, chalk, or ground eggshells the reaction is more complex than a simple dye process but it's fine to think of the dye as coloring the powder just as it colors cloth. (Weld photo courtesy www.essentialvermeer.com)

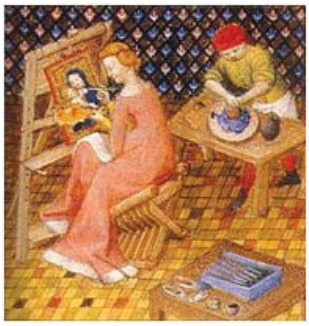
Some History

(Extracted and summarized from WikiPedia) Plants, insects, and shellfish have been used since ancient times to produce dyes. At various times in their growth the roots or leaves of some plants contain compounds that can be extracted by drying and boiling to produce a colored liquid.

■**BLUE: Indigo** lake was originally produced from the dye produced from leaves of the **woad** plant and was known in ancient Egypt. In the late Middle Ages the popularity of blue woad dye led to overplanting and soil exhaustion in many parts of Europe. After trade routes opened to the east, blue dye extracted from the indigo plant was imported from India as a substitute for woad since the indigo plant produces the same chemical but at lower concentration.

■**RED: Rose madder** lake, originally from the root of the madder plant, is also known as alizarin crimson in its synthetic form. **Carmine** lake was originally produced from the dried and ground up cochineal beetle, native to Central and South America. When the Spanish conquered the Aztec Empire about 1520 they encountered Aztec warriors garbed in an unknown crimson color made in this way. **Cochineal** became the second most valuable export from the New World after precious metals, in the form of the dried insect.

YELLOW: The **weld** plant is rich in *luteolin*, a substance that produces a bright yellow dye. The plant is cut before its fruits show fully develop, otherwise the pigment diminishes. Dye from weld serves well for linen, woolen, and silk and can produce all shades of yellow.



The person behind the woman painting the picture is her assistant, who is grinding pigment and mixing up small batches of paint so that the artist can work. Before about 1860 you could not buy ready-made paints, you had to create your own using pigments, and lakes, and use egg yolk or oil as a binder.

Doing part 1

Here is what you will need to do this part:

- an egg
- some paper or plastic cups
- metal spoon
- knife
- box of children's chalk ($1.19 at Osco)
- dinner plate (ceramic is best)
- cup of hot black coffee
- plain index card or a sheet of heavy white paper
- coin like a quarter
- several q-tips
- a few paper towels or napkins.

Here are the steps you follow:

1. Draw two circles next to one another in the middle of the paper by tracing around the coin. Write your name on the paper in letters 1" high.
2. Make a small quantity (a pile about the size of your pinky fingernail) of red or pink pigment powder by using the knife to scrape some of the red chalk into a paper or plastic cup.
3. Crack the egg into a paper or plastic cup. Wash the eggshell fragments with water (no soap) and pick out all of the sticky lining on the inside. Dry the eggshell fragments. (Keep the egg yolk and whites in the cup, we'll use it later.)
4. Using the metal spoon, crush half the eggshell on the plate. Use a rolling motion with the back of the bowl of the spoon. If you do this for about 10 minutes you should have a fairly fine powder. Put the crushed eggshell powder in a plastic or paper cup.
5. Get or make a cup of hot black coffee. You need a good dark liquid. Put a small amount of the liquid into the cup with the crushed eggshell powder and leave it sit for about 10 minutes, stirring it.

6. Pour the coffee off the crushed eggshell powder. Remove the powder and put it on a napkin, spreading it out so it can dry. Dry the "dyed" powder for several minutes, then gather it up and put it into a clean plastic or paper cup.
7. Using a spoon and your fingers and hands separate the egg yolk from the egg white without breaking the yolk. Take a look at this video at the link for this page on the Unit 3 web page of the course web site for guidance on how to do this. This silent video starts rather slowly with the artist fiddling around with a small knife and a jar of pigment but at around 42 seconds into the video she shows you how to handle the yoke to free it from all of the egg white. (NOTE: At about 75 seconds into this video the artist adds water to the egg yolk and adds too much of it. In addition to not being able to operate a camera and capture sound the well-intentioned soul who made the video added way too much water and makes a paint that is far too runny! Let's at least appreciate that she made the video at all…). You don't have to add water to the egg yolk—let's not.
8. Pierce the egg yolk and drip a few drops of the liquid yolk onto your scraped chalk pigment. Use a q-tip to mix the pigment with the yoke. Continue adding yolk in small amounts and mixing it with the red or pink pigment to make a paste-like paint.
9. Using a q-tip, paint one of the circles on the white paper with your chalk/yolk paint to neatly fill it with an even coating. Try not to have any white of the paper show through the coloring. Label this circle "chalk pigment and egg yolk binder."
10. Drip a few drops of the liquid yoke on the dry dyed eggshell powder pigment in a cup. Continue adding egg yolk in small amounts and mixing it and the dyed eggshell powder pigment to make a paste-like paint. Using a q-tip, paint one of the circles on the white paper to neatly fill it with an even coating. Try not to have any white of the paper show through the coloring. Label this circle "lake and egg yolk binder."
11. Clean up your mess and discard all of the cups, remaining egg yolk and egg shells.
12. Let the two colored dots on the paper dry overnight.
13. Once the colored dots are dry examine them carefully. **Write a paragraph describing what you think of the suitability of the pigment and egg yolk as a red/pink paint**. Does it color evenly? Is it very easy to work in great detail up to the edge of the circle (admittedly, using a q-tip as a brush is kind of crude!)?
14. Repeat step 12 to **write a paragraph to describe what you think the suitability of the dyed eggshell powder and egg yolk is for use as a brown or beige paint**. Does it color evenly? Is it very easy to work in great detail up to the edge of the circle? Is it very grainy or lumpy?
15. Take a picture of yourself holding the paper with your two painted dots so that your face, the paper and the two dots on it, and your name on the paper are all visible. E-mail the picture to the dedicated e-mail address for this course. In the message part of your e-mail copy and paste in the **two paragraphs you have written** (steps 12 and 13).

Project 3, Parts 2a/2b: typography and color

In this part of Project 3 you'll explore how an award-winning professional graphic designer and artist has used typography and color combinations in his work, and you'll provide your own perceptions and opinions of how his work follows (or doesn't follow) the "rules" of effective color use that you learned in this unit.

Carlos Segura is an internationally-recognized graphic designer who has developed several distinct typefaces (fonts). Visit a historical page from his web site (link is on the Unit 3 web page at the course web site, associated with this workbook page number) and learn about what he has accomplished. Segura has written:

> *Typography is beyond letters. Some fonts are so decorative, they almost become "visual" and when put in text form, they tell a story beyond words—a canvas is created by the personality of the collection of words on the page.*

Explore Segura's web site and get to this page which illustrates some of his graphic design work for CD recording firms. Explore all of the dozens of projects Segura has done in this area of work. Then do this:

1. Choose the graphics for three CD cases designs you the best, choosing from among designs that use **at least three different colors**. You can regard black as a color in this assignment.
2. Copy the front case image of each of the three designs you chose and put it into your word processed document (adding to the document you started for part 1) as an image about 2 inches by 2 inches, without distorting the proportions of the images.
3. In your document, create a section labeled "Part 2a: Use of Fonts". In this section write about a page in which you compare and contrast Segura's use of different fonts in each of the chosen designs with each of the other designs**. Identify which designs most effectively follow Segura's own statement above and seem most effective given its specific subject matter and musical genre.** To some degree this is subjective and depends on your own tastes, but support your identification of the strengths and weaknesses of your opinions with details and facts, considering the "personality" Segura attempts to achieve in each project through his font design. Use double-spaced lines, margins 1 inch all around and 12 point Times New Roman font.
4. In your document, create a section labeled "Part2b: Use of Color". Write a full page in which you compare **and contrast Segura's combinations of color use in the CD case designs you chose, in the language of the terminology of colors you learned in this unit.** Describe as informatively as possible Segura's use of colors on each CD case image as to hue, tint, shade, complementary or monochromatic colors. Indicate whether the overall effect is "warm" or "cool" and if you feel this is pleasing for the subject matter in each case. Support your descriptions and conclusions in specific detail in reference each design.

Project 3 Extra Credit – Typography

Typography is beyond letters. Some fonts are so decorative, they almost become "visual" and when put in text form, they tell a story beyond words—a canvas is created by the personality of the collection of words on the page.

In this extra credit assignment you get a chance to explore firsthand what Carlos Segura meant when he made the statement above. Here you are going to have the opportunity to create multiple "personalities" in the words to a classic musical work, which in itself associates different characters with different musical instruments!

Peter and the Wolf, Op. 67, is a composition written by Sergei Prokofiev in 1936 in the USSR. It is a children's story with both music and text, spoken by a narrator accompanied by the orchestra. You can read more about it at **http://en.wikipedia.org/wiki/Peter_and_the_Wolf**. To start this work, hear a performance in which the narration is done by Boris Karloff, an actor famous for his voice and the many parts he played in early horror movies. Use the link for this page at the course web site to access a recording of this performance. In the first two minutes and 40 seconds of this recording the narrator describes the musical instruments that the composer associated with each of these characters in the story: the bird, duck, cat, grandfather, the wolf, and Peter. The instruments were chosen so that the lighter, higher instruments mimic the bird, a deeper, meandering theme and tones mimic the duck, and so forth. The music itself seems to tell the story even when no words are spoken.

In a similar way, you need to associate each of these characters with a typographical font that seems to represent some of the "personality" of the character. Fonts are those different kinds of letter sets common to any modern work processor; each font has a name. For example, the bird might be represented by a font such as any of these, or even others:

bird: bird **Bradley Hand ITC**

bird: bird **Script MT Bold**

bird: bird **Blackadder ITC**

bird: bird **Brush Script MT**

Very appealing for a bird; the sloping curves of the "b" and "d" are suggestive of the way a bird stands…

while the wolf might appear something like wolf (Old English text MT) or WOLF (Algerian). Then you edit the words of the story as printed out in a document you can download from the web link for this page at the Unit 3 page of the course web site. This comes to you as a zipped file (zipped files always download instead of being opened, then you unzip them to extract the contents and work with them). The contents of the document are on the next pages for example purposes. In this example I have made the first font choices and started the process—see what you think of my choice. Make other font choices that seem appropriate to you, then change the font of all occurrences of the words in the story fragment so that each use of the word shows in the font you chose to represent it.

Project 3 Extra Credit: Meaning using fonts

To start this work, download the file for the text that follows, the link is on the Unit 3 web page at the course web site, associated with this workbook page number. Pick out a different expressive font on your word processor for each of the following characters in the story. Make the word here appear in your chosen font. Then replace the red "xxx" with the name of the font as indicated in your word processor. Once you have done that, use the fonts you have chosen to reformat the story below so that every occurrence of the word in the story appears in the font you associate with it, at 24 point size. **Bold** the word if it seems to improve the appearance as I have done here. I have started the first one for you as an example, but I formatted only the first two appearances of the word "Peter":

Peter Peter Segoe Script

Bird xxx

Duck xxx

Cat xxx

Grandfather xxx

Wolf xxx

Early one morning, Peter opened the gate and walked out into the big green meadow. On a branch of a big tree sat a little bird, Peter's friend. "All is quiet" chirped the bird happily.

Just then a duck came waddling round. She was glad that Peter had not closed the gate and decided to take a nice swim in the deep pond in the meadow.

Seeing the duck, the little bird flew down upon on the grass, settled next to her and shrugged his shoulders. "What kind of bird are you if you can't fly?" said he. To this the duck replied "What kind of bird are you if you can't swim?" and dived into the pond. They argued and argued, the duck swimming in the pond and the little bird hopping along the shore.

Suddenly, something caught Peter's attention. He noticed a cat crawling through the grass. The cat thought; "That little bird is busy arguing, I'll just grab him." Stealthily, the cat crept towards him on her velvet paws.

"Look out!" shouted Peter and the bird immediately flew up into the tree, while the duck quacked angrily at the cat, from the middle of the pond. The cat walked around the tree and thought, "Is it worth climbing up so high? By the time I get there the bird will have flown away."

Just then grandfather came out. He was upset because Peter had gone in the meadow. "It's a dangerous place. If a wolf should come out of the forest, then what would you do?" But Peter paid no attention to his grandfather's words. Boys like him are not afraid of wolves. But grandfather took Peter by the hand, led him home and locked the gate.

No sooner had Peter gone, than a big grey wolf came out of the forest. In a twinkling the cat climbed up the tree. The duck quacked, and in her excitement jumped out of the pond. But no matter how hard the duck tried to run, she couldn't escape the wolf. He was getting nearer, nearer, catching up with her. Then he got her, and with one gulp, swallowed her.

(There's more to the story but the above is sufficient for this extra credit assignment!)

