A COMPARATIVE STUDY OF SOME OF THE MODERN TECHNIQUES
USED IN REPRESENTATION ON A FLAT SURFACE

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BY

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PHOTOGRAPH OF A SILK SCREEN PRINT
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INTRODUCTION

This thesis deals with the changes and evolution of some of the techniques used in representation on a flat surface which have occurred through the passage of time and the meeting of new conditions.

By looking at various stages in the history of the development of processes, an attempt has been made to compare the various materials and media so that their suitability for modern usage may be judged to better advantage. The comparison has attempted to show a relationship of old to present day techniques. Yet the study by no means is meant to prove that the old techniques are vanishing, but on the contrary. Rather it is meant to show how long they have endured and how much they have developed.

Many artists today consider these new developments mere substitutes for the established traditional methods and believe that the best works can only be turned out by means of the former methods. A purpose of this thesis is to prove that theory false, and that these new techniques and variations of old techniques are useful for individual problems presented to the artist today. New techniques may be used in the more rapid pace of the present age in the same manner as the old techniques were used in other ages--commensurate with the ability of the artist.

Another reason (of primary importance to the author), for compiling such material in a thesis is to eliminate much detail of various techniques in order to get at their
fundamental forms. By such treatment these techniques and their backgrounds will be more quickly grasped by persons about to set out on an initial experience with any one of them and is of much importance in presenting the method to a student. For this reason the illustrations have been kept simple and the clarity of the performance of first consider-
tion.
CHAPTER I
LITHOGRAPHY

This technique was invented by the German, Alois Senefelder (1771-1834) and he wrote a book to tell of it.\(^1\) The inventor was an unsuccessful actor who attempted to do his own printing and publishing. He was forced to experiment with various methods using metal plates, stones, acids and inks. In 1798 he discovered how to do "lithography-chemical" surface printing, a resist method based on the fact that grease and water will not mix. He was recognized for his invention by the English in 1801 through the Royal Society of Arts. His particular technique was called "Polysautography". Benjamin West, Philip Andre and others were quick to use it. Goya in Spain heard of it and although his method was unorthodox he made some wonderful lithographs. Gericault, when he was in London, learned the process and Bonington, an Englishman, learned it in France. The ability of these two men had much to do with bringing the technique to the attention of the public and the medium began to gain popularity. Before long lithography was being used for the illustration of the lengthy books then in vogue. Gericault went farther with it than the fashionable amateurs who first experimented with it. His boxers and horses are among the best known of his prints. Delacroix mastered the technique as may be seen in his print the Tigre Royal and his illustrations for Faust and Hamlet.

\(^1\) Senefelder, Alois, The Invention of Lithography, translated by J. W. Muller.
Daumier perhaps the greatest of lithographers was doing his illustrations for the magazine L'Artiste and the newspaper La Caricature with this method.²

Lithographs were very popular with the artists themselves until about 1840 when etchings came in competition as a technique. Commercially lithography was supreme. Its easy possibilities of color printing (Examples—Currier and Ives prints) cheapened it and brought it in disfavor.

This form of flat surface representation did not vanish at once with the invention of photographic reproduction.

As the century wore on, Manet in France and Whistler in England experimented with the style. Finally by the time the invention was a century in age, the process was being promoted by the Paris Salons and the Ecole des Beaux Arts. The prints were again seen in newspapers and magazines. Toulouse-Lautrec, Blanche and other painters distinguished themselves with their lithographic prints.

At the turn of the twentieth century the process found lithographic clubs or organizations that sponsored the promotion of the technique in many countries. In New York the Grolier Club gave an exhibition in 1896. Arthur E. Davies, Charles Locke and George Bellows were among the exhibitors.

In England the Senefelder Club was organized with Joseph Pennell as the president. John Copley, Spencer Pryse and Frank Brangwyn are some of the outstanding members of that club.\(^3\)

Several new innovations were introduced to the process which stimulated the interest in it. The heavy stone was discarded for metal plates. Aluminum plates were found more satisfactory than zinc. Transfer paper was improved. The artist found that he could print his own lithographs on his own press as well, if not better than the commercial printer.

Some authors consider George Bellows the twentieth century's foremost lithographer. At any rate he brought the technique from the abuse of the commercial field back to the realm of aesthetics. He became interested in lithography in 1916. In the remaining nine years of his life, he produced about one hundred and ninety-five prints.

One author speaks of Bellows:

Bellows not only revived lithography as a fine art, but earned for himself the right to inclusion among the great printmakers of all time. In beauty of tone, in silvery grays and velvety blacks, in skill of draftsmanship, in force and originality, Bellows ranks with the immortal Daumier—that which no higher honor can be given. Critics who denied Bellows the name of painter, never hesitated to laud his accomplishments in black and white.\(^4\)

**TECHNICAL PROCESS**

The process of lithography is done by drawing with a

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\(^3\) Rhodes, Henry J., *The Art of Lithography*.

\(^4\) Boswell, Peyton, Jr., *George Bellows*, p. 23.
greasy crayon or "tusche" on a stone, metal or paper surface and then printing very directly.

The best medium on which to draw is still the special lithographic stone which has a very fine grained surface. The disadvantage of using a zinc or aluminum plate instead of a stone is that the metal surfaces become more greasy. However the advantage is to the more portable and available material. Tracing paper or any good paper may be used to transfer the drawing to a hard surface for printing.

When the drawing is ready to be transferred, it is placed between moist acid blotters for about thirty or forty minutes. After this the drawing is dropped on the stone or plate which has been placed in position on the press. A paper or fibre board backing is placed on the drawing and the whole stack is run carefully through the press.

In making the print, a special lithographic ink of dry color and linseed oil is used which is resisted by wetness. It may be softened with varnish. This is applied evenly to the stone or plate by means of a roller and pressed quickly before drying. Each sheet of paper is placed on the stone or plate as it rests in the press bed and a sliding pressure is applied.5

SERIGRAPHY

Serigraphy or silk screen printing is a comparatively recent development that has been used to great advantage in commercial advertising. Its popular usage has tended to

5 Wengenroth, Stow, Making a Lithograph.
lower the quality, and silk screen printing in general is not considered an artists medium. However its use for reproducing and creative printing is inexhaustible and it may well take the place of lithography for illustration. Banners, posters, wall decorations, signs, magazine covers and greeting cards are a few of the popular things done by this method. The process may also enter the realm of fine arts in many of these representations. In connection with new materials turned out by modern science such as plastics, pressed wood and variations in textiles, serigraphy is being used for decoration. Also the process is excellent for educational purposes. Children especially like a reproducing process. Oil cloth shelving, cork plate mats, game boards, table accessories and clothing may be attractively decorated.  

TECHNICAL PROCESSES

The process is done by means of squeezing paint through a silk stretched frame. The design for the silk is made by variation of stencil.

The wooden frame can be home-made of white pinewood. The size of the frame should be larger than the intended print. Then the silk is cut larger than the frame and tacked on while stretching it. When only one screen is needed, organdy may be used in place of silk. Push-pin hinges are attached to one side of the frame and to a stationary base. A door spring may be attached to keep the wet screen away.

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6 Biegeleisen, Silk Screen Stencil Craft As A Hobby.
from the base after each print has been removed. The base should be smooth and could be a drawing board. A reinforcement of gummed cloth or paper is placed over the silk on the frame and allowed to extend about a half inch into the silk. This should be done on both sides to make the screen leak-proof and easier to clean. The screen is then ready for the printing process.\(^7\)

There are three fundamental methods to obtain a stencil on the screen. The easiest is to merely cut from paper the intended pattern and place the pattern under the screen next to the printing paper. This stencil may be pasted or lightly glued to the screen. This same principle may be applied in simply coating out with shellac the areas where the paint is not desired to print.

The second method is by use of a film such as nu-film or blu-film. This method has been popular in commercial work because it produces sharp prints and may be stored away until future use. The procedure is quite like the stencil paper method. The difference is that the specially prepared film is in two sheets of paper: the layer of plain tracing paper and the layer of glassine or wax paper, which supports a thin layer of lacquer. The wax sheet is cut away with a film stencil knife where the design is to print. The whole sheet is then placed in position in the registry guides on the base. The screen is lowered to the sheet. The film is transferred\(^7\) Ibid.
to the silk by alternately rubbing a rag soaked with adhering liquid and a dry rag over the top of the surface. The screen is then turned over and the paper backing is stripped off, leaving an open stencil ready for printing.

The third method, which is called the tusche method, is the most intriguing to the artist because of the flexibility of the medium and the variations of texture obtainable. The same tusche used in lithography may be used on the screen. This black greasy liquid is applied with a brush in the areas intended to print. A grease pencil may be used instead of the liquid tusche.

The screen is first lowered over the drawing and either traced on with a pencil or tusched on directly for each plate intended. A separate place or stencil must be made for each color. When the brushed on tusche has been allowed to set for fifteen or twenty minutes, a solution of glue and water is prepared and put on. Two coats of glue should be scraped over the whole surface of the screen with flat-edged pieces of cardboard, smoothing the glue to an even surface. After the glue is completely dry the tusche is taken out by means of rubbing a toothbrush over one side of the screen and keeping a kerosene or carbon tetrachloride soaked rag on the other side. The tusche should disappear leaving the areas to be printed open.

Two kinds of paint may be used in the printing process and are usually known as "process" colors. But by adding various fluids to the oil base paint or water soluble pigment,
their consistency, opacity and finish may be changed.

These process colors come in a jelly-like form. Their consistency may be regulated by adding a transparent base or a liquid thinner. The oil colors have a few advantages over the water soluble colors in that they are more permanent and may be used on materials such as metal and glass. However the tempers colors are sufficient for indoor work on posters and other designs.

Lacquers and dyes are an improvement on paint for printing on textiles. However this process is done somewhat differently.\(^8\)

Etching compound is a medium particularly suited for screen printing on a glass surface. After running the compound through a screen stencil onto the glass, hold the glass under water for a minute and the design will be permanently etched into the surface.\(^9\)

**COMPARISON**

Lithography as a multiple print process has a relationship to serigraphy, specially in the tusche method. In serigraphy however, the tusche is removed before printing. In lithography it is left to stick to the ink.

It is easy to see why their usage might run parallel. Each can turn out a great number of prints.

But for the present day solution, the only place where lithography would be serious competition is to the silk screen

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\(^{8}\) Biegeleisen, *op. cit.*, p. 48.

\(^{9}\) *Ibid.*
process is where the better artist is concerned. Lithography takes too long and is too complicated to capture the interest of the artist. Commercially it is now related to photographic processes. Serigraphy is simple and inexpensive. A complete set of serigraphic equipment can be purchased for less than five dollars. Considering the many uses applicable to the school art program, this appears to be a wise investment.
A SILK SCREEN PRINT
CHAPTER II

WOOD BLOCK VERSUS LINOLEUM BLOCK

According to the definition of Arthur M. Hind, engraving is "the art of drawing or writing on any substance by means of an incised line."

The origin is controversial. Since the incised line could be a notch in a tree, W. T. Linton has this to say about the beginning of woodcutting:

The first Notch-Cutters may be considered, in default of other claimant, Noah, Adam, or the angel Razael, as the father of our Art, the Inventor (need one be had) of engraving-in-wood.

Engraving was done in ancient Babylon and Egypt. In both of these civilizations engravings or stampings were done on brick before the clay hardened.

The earliest prints on paper that have been found are from the T’ang dynasty (618-905 A.D.) of China. These prints were woodcuts of one color, used as cheap substitutes for religious paintings to be placed in the homes.

In the eighth century, the Japanese borrowed the style for reproducing their popular religious figures. These artists, like the Chinese artists, still valued painting as a higher classed medium. However, the prints done were usually first rate.

10 Hind, History of Engraving, p. 2.


12 Prior, E.S., Graphic Arts, Encyclopedia Britannica Booklet #14, p. 70.
The earliest discovered impression from a woodcut is dated 1418. The stamps were from crude wood blocks and done in Holland and Germany. These were gaudily colored to illuminate books.\(^{13}\)

However previously in Europe, at least since the sixth century, blocks of wood had been cut for the purpose of printing designs on textiles.\(^{14}\) Later Venetians and Genoese carried the practice of printing on stuffs into Western Europe, some remains dating as far back as the twelfth century. Cennino Cennini describes the method of printing on textiles in his "Trattato" of the fifteenth century. When books were still being hand-lettered and hand decorated by monks and chained to library tables, the inexpensive prints of woodcuts were reaching the common people and acting as their literary source. After Gutenberg invented printing in about 1436, the woodcut became the logical means of illustration. This form of illustration continued as common practice until late in the eighteenth century when taste demanded the more delicate use of copper plate engraving. However the nineteenth century saw the revival of woodcuts as the main medium of illustration for the press and books.

Early in the fifteenth century the black line woodcut developed from a crude form. By the latter part of this century Albrecht Durer was making complex drawings on the block

\(^{13}\) Linton, \textit{op. cit}.

\(^{14}\) Bliss, Douglas Percy, \textit{History of Wood Engraving}.
for the craftsmen woodcarvers to cut in varied line and texture. This art under Durer is said to have reached its maturity in Germany. His purpose for using the woodcut was to reproduce his drawings and paintings and he was the first artist of high rank to use the woodcut extensively.15

Hans Holbein designed expressly for the woodcut. The woodcutter Hans Lutzelburger carved the drawings of Holbein with as high a degree of perfection as has ever been attained.

In France the woodcut was put to use as illustrations for frequently published Books of the Hours. French masters of this technique in the sixteenth century were Jean Cousin and Bernard Salomon.16

The black line method had been the only way of making a woodcut until Thomas Bewick (1753-1828) exploited the white line method in the latter part of the eighteenth century. He had been apprenticed to Ralph Beilby, a copperplate engraver, but after Berwick won a medal for his woodcut "The Huntsman and the Old Dog", he kept working with the latter medium. His illustrations of many books played an important part in the nineteenth century revival of woodcuts.17

A contemporary of Bewick, William Blake, also played an important part in the future of woodcuts using the white line

15 Prior, E.S., op. cit.
16 Jackson, Treatise on Wood Engraving.
17 Bliss, op. cit.
method and they are not particularly skillful in technique. But they are plastic in the modern sense of the word. Hence his work has a great significance to anyone engaged in woodcutting and wood printing today.18

The process of woodcutting had ceased to compete with photography and other sharper mediums for illustration until the French introduced other freedoms. Felix Vallotton used bold areas of plain dark and light. Paul Gauguin left about a dozen cut blocks and their strange barbaric designs showed a new phase in the development of print making. Direct improvising on the block to suggest the character of a design was done by Gauguin and French artists have since followed his suggestion. Thus their craftsmanship has been less careful than their English contemporaries. A multiple tool, "velo" for saving labour in line making was introduced by the French.19

The modern tendency is in line with the other trends of art development. The mental approach has largely turned away from imitation to obtain more creative conceptions.

TECHNICAL PROCESSES

The woodcut or linoleum cut makes prints by means of raised lines or areas that catch ink from a roller and deposits on paper under pressure. Area printing is called wood block and line printing is called woodcut. Two kinds of woodcuts are done in opposite manner. In the black line method

18 Ibid., pp. 203-226.
19 Ibid., pp. 230-240.
the wood is cut away wherever the lines of the drawing do not show. In the more natural white line method, the white area that is gouged out will receive the attention.

For the black line method a soft wood like sycamore, apple, cherry or beech is used. It should be sanded to a smooth, level surface. A sharp knife may be used but regular woodcutting sets are better. The tools are usually made to fit the palm of the hand and the sharp cutting edges have different shapes for the various cutting purposes. A "v" shaped tool is used for gouging lines and other tools have been devised.

The white line method is done by engraving into the end grain of a fine hard wood such as box-wood. Burins and scooper tools are pushed forward while the knife is pulled toward the body.

Printing the woodcut may be done either by hand or on a regular type printing press. Either the oil-base ink or water soluble ink may be used. The ink is spread on a glass or marble slab with a composition hand-roller. It is then rolled on the block by several movements in different directions. The paper is then placed over the block and pressed. A hand presser or baren of bamboo covered wood is used by the Japanese for rubbing the ink into the paper. A soft hand-made paper is good for absorbency. If the paper is tacked down at the corners and the block placed in a fixed position, the paper may be raised at the corners to test results. Control of the pressure in hand pressing can give a varied quality to the
general tone.20

LINOLEUM BLOCK CUTTING

Linoleum is a term coined by Frederick Walton for material of his own invention. He received a patent for it in England in 1636. The process of the patent was for painting with oil colors on a woolen cloth. About two decades later another patent for a linoleum was obtained by Elijah Galloway who softened india-rubber by heating it and incorporating it with cork dust. Today the material is made by many complicated commercial processes, usually boiled to a sticky liquid substance, put on cloth or felt and allowed to harden.21

For the block print, if it is wanted type high, linoleum is put on a more stationary wood backing. A coat of white is sometimes added to the linoleum surface to aid in laying out the design on a smooth surface.

TECHNICAL PROCESS

The process of designing and cutting the linoleum block is done in precisely the same manner as in wood block cutting. However the cutting tools may be simplified because the texture of the material makes it easier to cut. But the tools must be kept sharp in order to obtain sharp, clean lines.

The first step in printing a block is inking or charging the block. Regular printers ink is most desirable for durability. It is mixed to the proper consistency on a glass or marble slab, then rolled out by means of a brayer until

20 Prior, E.S., Graphic Arts, op. cit., p. 68.
the ink is evenly distributed. Next charge the block by
rolling the brayer in different directions on the block. The
block may then be printed either on a press machine or by
hand pressure.22

COMPARISON

The woodcut printing method is probably a better medium
for expression in the hands of an experienced artist. But
for the student, linoleum has many advantages over wood.
Linoleum block printing is more simple and lends itself more
quickly to many applications. The tools and equipment re-
quired for the linoleum cuts are also more simple and conse-
quently less expensive. Both will print many impressions but
linoleum would tend to break down first.

Since the invention of photo engraving linoleum block
prints are still used in advertising and for book illustra-
tions but the woodcut, because of its difficulty in handling,
is rare.

For the school problems, linoleum blocks are ideal.
Students may make greeting cards and decorative compositions
of the seasons. Illustrations may be made for school pro-
grams and year books in many colors. Their use in textile
design is unlimited.

22 Sprague, Curtiss, How to Make Linoleum Blocks.
A LINOLEUM BLOCK PRINT
CHAPTER III

WATER SOLUBLE VERSUS OIL PAINT

Many recipes or techniques of laying paint on a two-dimensional surface have come down to us through the centuries. Many of these concoctions have been proven to be impractical while others have become popular. A few techniques have found themselves particularly suited to the conditions of their age and their basic elements compatible with the surface on which they were placed. The water soluble processes, as written down by Cennino Cennini in the fifteenth century, were found to answer the needs of the artist then. Oil painting, as the technique was evolved by the Van Eycks in Bruges, is another example of growth and adaptability.

Techniques of painting may be studied even of pre-historic man as seen in the caves of Altamira, Spain. The technique there involved the grinding of pigments such as soot and colored earths with grease and applying it to the stone cave surfaces.23

Chinese painting derived from picture-writing. Their painting goes back into the centuries too far to establish any definite evidence of the origin. Their traditional style was done in water mediums on cotton, silk, and paper and in oil and varnish on wood. During the Sung dynasty (960-1260 A.D.) their water painting technique reached a high

degree of perfection when the sizing, for the fabrics to be painted, was made finer and smoother on the surface.

The materials of the ancient Egyptians and Greeks were somewhat the same. Both used a gum solution in water. Both cultures painted their buildings and statues. Both used the durable method of wax painting, sometimes referred to as encaustic. Evidence has been discovered in both cultures of the use of mixing varnish.24

A very complete study of pigments and media used from the time of the ancient Egyptian and Byzantine cultures may be found in a book by A. P. Laurie. He wrote of the chemical contents as well as giving a synoptic historical background.25

Traditional techniques of the ancient classic civilization were preserved to a certain extent by the later Roman Empire at Constantinople. Processes of wax painting, drying oils and varnishes were mentioned in the Mount Athos handbook and later written more completely by a twelfth century monk, Theophilus Rugerius. The beginning of fresco painting is more controversial, but the use of wet pigments on fresh plaster was discovered in Crete.

After the fall of the Roman Empire in the East, little is known or done with the processes of painting. The large Byzantine ikons were done in mosaic. From the seventh to

the twelfth centuries painting was almost entirely in the hands of various monastic orders. Their outstanding achievement was in illumination of manuscripts. Some of the early collections of recipes written well before the height of the Renaissance and of great value today are as follows: The Manuscripts of Lucca and Strasbourg, of Cennino Cennini, of the Monk Denys, and of Jehan Lebeque.26

During the Renaissance first in Italy, then throughout Europe, an important change took place in the technical processes of painting along with some entirely new principles. The traditional tempera painting had come into popular use throughout Italy from the crude beginnings in Byzantine and early Christian art. At the introduction of easel painting, the egg tempera process was the means of execution. Because of the strict and thorough training of the apprentice to the master, not much experimentation was carried out by Italian craftsmen. But new methods and materials are supposed to have been initiated in Flanders in about 1400 A.D. This new technique in oil was perfected by the Van Eycks and introduced to Italy where it gained popularity until it became the favorite technique of most artists by the end of the fifteenth century.27

However tempera painting has never died out. Many innovations and modifications have been introduced to the

26 Hiler, op. cit., pp. 18, 19.

standard technique as set forth by Cennini. In the sixteenth century tempera paintings were often done on canvas instead of wood. Painting on canvas had been introduced with the technique of oil painting. Today egg tempera painting is even done on ordinary water color paper.28

As Vasari and other writers have pointed out, oil paintings were done for the most part, in the same manner as egg tempera paintings. Sometimes alternate coats of tempera and oily glazes were used. Sometimes different coats of transparent and non transparent oil paint were used. These coats were usually applied in the accepted tempera style.29

Hence it may be seen that egg tempera painting is still the background for water soluble paintings. Therefore, to understand the evolution of painting, a knowledge of the traditional technique seems imperative.

TECHNICAL PROCESSES

Egg tempera painting is done with powdered pigment mixed with the white of egg or an emulsion of the whole egg preferably on a gesso primed panel.30

For the purpose of clarity and visualization of the whole process, a step by step outline has been condensed from translations of Cennino Cennini's technique. This Cennino of

28 Ibid., p. 16.
29 Doerner, Max, The Materials of the Artist, pp. 185-191.
30 Thompson, D.V., Translation of the Craftsman's Handbook by Cennino Cennini.
Colle wrote of other techniques which have also proven invaluable to the craftsmen of today.31

Cennino was apprenticed for twelve years to Agnolo, son of Taddeo of Florence.32 Thus his technique should be considered standard for his period.

1. Today the wood panel may be of ply-wood or any smooth hard surface wood, and a composition board such as Masonite is quite practical.

2. Sizing is necessary to enable the ground to adhere to the wood. Two or three coats of size is laid on the panel with a bristle brush. Allow each coat of glue to set properly before applying the next coat. The panel is dried thoroughly before the linen is stuck on.

3. Clean linen is immersed in hot size and stretched out over the panel. If the panel is large, strips of linen are used. Keep the thread lines even with the edge of the panel and lay on before the size has a chance to coagulate. After drying a sharp knife is used for trimming the edges and sandpaper is used to rub down the uneven surface.

4. The gesso priming is made with a whiting such as fine plaster of Paris and a size. In this case rabbit skin glue was made by dissolving the skin in hot water. The two ingredients are mixed until a creamy consistency is obtained. Lay on the ground very evenly by using a bristle brush or a

31 Ibid.

32 Harringham, C., The Book of the Art of Cennino Cennini, p. 5.
smoothing trowel for each coat. Put as many layers on as is necessary to take the moisture from the future painting. Sandpaper to a smooth finish.

5. The cartoon is made and transferred to the primed panel and the painting is ready to be started. A preliminary cartoon or drawing is preferable to painting directly as the undercoats of paint are important.

6. For background and draperies which should be done first, Cennini recommends putting the successive layers of wash, working from dark to light. Then work from light to dark. These lights and darks should be prepared ahead of their application in an efficient manner (i.e. specific amount of color and white for each gradation). Skies of blue or grey should have a grounding wash of earth color and white, over-which the desired intensity of sky color is laid. Then clouds may be put over the sky. This manner of working from the background to the foreground should be carried throughout any painting in tempera. By so doing, neat edges are kept and a general efficiency is maintained.

7. Flesh painting requires a different treatment. After the background has been completed, two coats of terre verte are laid on in flat washes covering all flesh. Aim to make a coat of even color. This serves to enrich the warm flesh tones as they are laid over the dull green. Verdaccio, a warm yellow mixture, is used to model the form with the terre verte grounding left untouched for the highest lights. Next apply the red coloring in a thin glaze over all the sur-
face of the flesh. The final overall cast is a flesh tint of ochre, vermilion and white. Prepare it in three gradations by adding white. Paint the lightest first. Pure white may be used delicately for the highest lights. Finish the flesh painting by touching up the outlines and putting in necessary accents. A semiglossy surface should be obtained by use of these many thin washes of super-imposed color. Thick paint may crack.

8. A picture should be left for a year before it is varnished. The best varnish is prepared from juniper or sanded resin and linseed oil (two parts linseed oil to one part juniper. Warm the oil in a pot and put the juniper into it, a little at a time. Cook them slowly together until the whole is reduced to about two-thirds of the original quantity.).

9. Burnished gilding and mordant gilding are the two kinds of gilding used by the Italians in the Renaissance period. Gold leaf is laid on an adhesive surface over a bole or terre verte. Burnishing is done with a warm agate by moving the tool gently over the surface, gradually rubbing harder. Do not varnish over the gold. In mordant gilding the leaf is laid by means of a gold size.33

The following water soluble processes have been studied primarily because they are more suitable to a school art program. They are less complicated and less expensive than the traditional egg tempera process. However, each of these

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33 Ibid.
techniques has a different place and fits a different need. One may be more suitable for essel, whereas another may be better for a mural.

GOUACHE

Gouache is a method of painting with opaque colors which have been ground in water and mixed with a preparation of gum.34

The gum binder is made from gum arabic, either acacia or senegal in either tears, granulated or bulk form. It is prepared in a double boiler (like cream of wheat). Distilled water is put in top and after coming to a boil, the two parts gum is added slowly to insure that all particles dissolve. Stir until lumpy. Strain through a cheesecloth and the result is the binder. The ground colors are added to the binder and ground together until the consistency of rich cream is reached. Then it is put in a glass jar and a little distilled water added to the top. Add a few drops of formaldehyde to preserve color. A 100 per cent linen fiber paper should be used for gouache painting because it is durable and practical. Avoid any use of paper or boards containing a filler of glue or the paint will "slide". The best brushes for gouache are the short, square, bristle brushes.

The best approach seems to be in a method first of transparent washes, building up to the opaque but never letting the paper dry. If the paint begins to get a flat quality on the

paper, bleached beeswax (three parts dissolved in one part turpentine) may be brushed on the gouache after it has dried a few months. The brilliance returns. They may then be framed without a glass and a dust rag may be used on them.\footnote{Lonergan, John, \textit{Gouache Painting}.}

**CASEIN, GLUE AND SOYBEAN**

The necessity for speed and the lack of any need of durability in commercial painting calls for the use today of a simplified technique. Also the school art problems in painting demand a simplified method of introducing paint qualities to a student. All three of these new mediums casein, glue and soybean may be used for school painting problems but one may be a little better than the others in individual cases.

A casein is an agglutinant made from cheese or precipitated from milk by the action of rennet and other methods.\footnote{Hiler, \textit{op. cit.}, p. 323.} Emulsions of casein solutions and oil may be mixed with pigments very easily. They form a protective film and are quite stable, but are not permanent.\footnote{Mayer, \textit{op. cit.}, p. 197.}

Prepared casein tempers colors have been manufactured for commercial sale for some time. No standard formules have been reached for the various companies who make them but the casein colors of the Ramon Shiva company of Chicago are exceptionally good.

In the Shiva brochure they disclose that their casein colors may be used as a gouache, tempers, transparent water
color or fresco secco. They maintain that the colors do not need to be combined with anything other than water. The colors are water soluble while fresh but become insoluble after drying. It is possible to super-impose them repeatedly without removing the underpainting. This particular company advocates the use of their colors because they are permanent to light, gases, alkalies and acids; also because they may be used on many kinds of surface including wood, gesso, canvas, paper, cement, plaster and wet or dry lime walls. It is true that their colors have excellent adhesive qualities.

The technique as set forth by Cennini may be used to a certain extent in mixing the casein and oil colors. The principle of water underpainting and oil glazes is recommended as follows: 1. Use water with casein colors to vary their consistency for the underpainting. 2. Apply a thin coat of etheral varnish over the painting to act as an isolator from the oil. 3. Mix the oil colors to a desired color hue and reduce with glazing varnish. The glazing varnish acts as the medium to vary color value as well as hue. This glazing may be applied in as many coats as is necessary to gain the desired quality. Casein coats may be applied over the glaze coat after the latter has dried. The Shiva casein colors, when used as a gouache or tempera, may also be varnished.39

38 Letters and Brochure from Shiva Artists colors.

39 Ibid.
The soy-bean, which has recently been grown extensively in the mid-western United States, has excellent properties to mix with plain pigment and water.

Another simple method of painting that is particularly adaptable to a temporary school mural project is by use of glue and water with powdered pigment. Any kind of glue sizes may be employed and only enough should be mixed with the pigment to act as a binder. By spraying a glue-color mural with a 4% formalin solution, the mural will become nearly insoluble to water. Wax soap may be applied for the same purpose.40

COMPARISON

The primary reason that the popular technique of professional artists shifted from the traditional method of egg tempera to oil painting was because of the greater freedom allowed. After the Van Eycks perfected the oil technique, many artists saw that it was a more direct approach and consequently took less time. However it produced an entirely different effect. Therefore, then as now, the artist made a choice of techniques that was of vital concern to the outcome of his paintings.

For the answer to the question of which techniques are best for school use, the author believes each situation warrants a variation. However in most cases, a simplified approach seems advisable with due regard for the properties of the materials and an eye to learning from the Old Masters.

40 Doerner, M., op. cit.
PHOTOGRAPH OF

AN EGG TEMPERA PAINTING

ON A GESSO PANEL
CHAPTER IV

LACQUER VERSUS FRESCO

The origin of fresco painting is open to controversy. Some believe the technique dates back to prehistoric Egypt when the walls were decorated with the deeds of mortals and judgements of the gods. But reasonable assurance is given that the walls of the palace of Knossos in ancient Crete were decorated with true fresco paintings. The date assigned to these murals is 1500 B.C.

Long before the Christian era the Etruscans made use of the true fresco. No adequate testimony has been given concerning the presence of fresco painting in Greece, but the writings of Vitruvius and Pliny the Elder throw some light on the subject for imperial Rome. In the late Renaissance Vasari wrote that "the ancients" used the fresco technique.

In the medieval and early Renaissance periods, the use of fresco painting grew in popularity and to a high degree of technical perfection. Mrs. Merrifield, in her treatise on fresco painting drew from sources of the Italian renaissance writings of Cennino Cennini (1437), Leon Battista Alberti (1485), and the later writings of Vasari and Giovanni Battista Armenio (1587). She also got material for her book from the writings of a few Spanish masters. These men gave directions concerning various media and they usually dwell thoroughly

41 Hale, Gardner, Fresco Painting, pp. 50-55.
42 Laurie, op. cit.
with the preparation of the "intonschi" or layers of mortar and plaster covering the walls for the paintings. They also tell of the variations in technique from true fresco.\textsuperscript{43}

True fresco painting is "painting on wet lime plaster".\textsuperscript{44} Since the time of Cimabue and Giotto in the early renaissance, variations have been introduced until the basic qualities of fresco painting is seldom recognized in a mural painting. This is specially noticeable in fresco-secco which is done on a dry ground.

In secco painting, all sorts of technical combinations have been practiced. Often the underpainting is true fresco and then finished in secco.\textsuperscript{45} There are various ways of doing this, one of which is referred to later in this chapter.

Fresco painting, through the annals of time, has had its moments of popularity as well as decline. But the confinements of its technique has given it a simple dignity and significantly it has maintained an important place in the history of painting.

TECHNICAL PROCESS

The process of painting in fresco as explained by Mr. Jose Clemente Orozco is quite similar to the original buon (true) fresco of the Old Masters. Other related processes

\textsuperscript{43} Merrifield, Mary P., The Art of Fresco Painting as Practiced by the Old Italian and Spanish Masters.

\textsuperscript{44} Doerner, op. cit., p. 265.

\textsuperscript{45} Ibid.
may be added but the fresco technique as explained by him is comparatively simple. For the Museum of Modern Art, Mr. Orozco did a series of six separate panels in fresco to be placed in position against a wall after their completion.

The plaster on which the painting is done is the same as for ordinary walls, lime and sand or lime and marble dust. A small amount of Portland cement may be added to make the material harder but it is not necessary. No cement may be used for the "intonaco" or final coat. The number of coats of plaster depends on the kind of material of which the wall is made. The best material for the wall is the old hand-made brick because the machine-made brick is as waterproof as concrete. The plaster proportions: two parts sand to one lime or two parts sand to one and a half lime. It should be made to hold a great deal of moisture. Pigments are diluted with water only. Colors are mixed in glasses with a plentiful supply for mixtures. Only lime proof colors are used by Orozco: earthen colors, mars colors, cobalt, chromium oxide, non-animal blacks and lime white. Good cadmiums also may be used very thinly. The main lines of the underpainting are painted directly on the wall panel in Venetian red. The binding medium is the carbonate of lime produced during the drying process of the plaster. Orozco used a method of polishing the surface with a small pointed trowel in the direction of the brush strokes to seal in the pigment and deepen the color. When he wanted to make a change, he would brush out as much color as possible and apply fresh intonaco over the
desired spot. A fresco is never varnished.46

When durability is not required, many experiments have been tried to find a method that is more rapid than fresco. Tempera and oil for mural work requires a preparation of gesso over the wall. Until recently the modern mural decorator painted on canvas and the canvas was fastened to the wall. About fifteen years ago, Boardman Robinson executed some large murals in a Pittsburg department store with automobile paint. The medium had obviously brilliant color qualities.47

LACQUER

A Latin American named Miguel Covarrubias has used a technique for murals that has proved highly successful. At the 1939 Exposition at San Francisco, he did a series of illustrated wall maps representing the Pageant of the Pacific. They are still in the Pacific House. The painting medium employed was a flat duco lacquer with a nitrocellulose base. It was handled not as an opaque lacquer, but by applying pure pigments with a clear lacquer diluted with lacquer thinner. The particles of color become imbedded with each brush stroke into the heavy nitrocellulose base. It is dissolved instantly by action of the thinner. In this manner a permanent, hard and washable surface was obtained.48

46 Orozco, Jose Clemente, Orozco Explains.
47 Hale, op. cit., pp. 63-64.
48 Covarrubias, Miguel, Lacquer Fresco Technique.
COMPARISON

For durability, time has proven that there is no real substitute for fresco as far as the old materials and techniques are concerned. However this century has turned out many new materials, some of which are stronger and more durable than anything produced before. Perhaps one of these new materials will offer a better solution to better durability. On the other hand, the need for permanent murals may entirely vanish if the present trend in architecture continues.

At any rate, all possibilities of new materials should be investigated. Covarrubias technique certainly has some merits. The color is clean and brilliant, not foggy as is often the case in fresco works. The laquer style allows an almost unlimited range of color and like fresco is unimpeded by fatty mediums that constitute the base of most paint.
PHOTOGRAPH OF THE

LACQUER-FRESCO TECHNIQUE

ON A WOOD PANEL
CHAPTER V

PHOTOGRAPHY VERSUS ETCHING AND METAL ENGRAVING

The purpose of this chapter is to show that photography has a place in the line-up of today's means of flat surface representation. In the present century this reproductive process has not only taken over a great number of the uses of other graphic arts, but also has enlarged upon itself.

Because woodcutting and wood-engraving, as well as lithography, has already been dealt with in this thesis as a means of illustration, etching and steel engraving has been selected to be compared to photography. The author reiterates that a complete and thorough treatment of these techniques is not intended. Rather a summarization has been used in order to better comprehend each technique in relation to others.

According to Lippman; "the word 'engraving' means, in its narrower sense, work with the graver, as opposed to etching; in its wider sense it covers the whole of those processes by which a design is engraved on metal for the purpose of being printed."49 Etching is usually referred to as the process of biting lines or areas on a metal plate by means of an acid or some other chemical.50 Often these two processes are combined in use, or perhaps with other related processes such as mezzotint or dry-point.

Metal plates adaptable to printing came into existence far back into ancient time. The goldsmiths and other metal

49 Lippman, Etching and Engraving, p. 6.

50 Popham, Alfred E., Graphic Arts, op. cit.
workers of the Etruscans, the Romans and later the medieval craftsmen, were employed in the technique of engraving. The facts are not known of the invention of engraving for the specific purpose of printing on paper. From all appearances, woodcuts were already being used and supplied the inducement for the development of line-engraving.51

The first etching, to which any date may be attached, was a portrait done by Daniel Hopfer who worked from 1493-1536. He was one of a family of armurers who worked in Augsburg.

Urs Graf (d. 1529), a Swiss dated his earliest etching in 1513. Albrecht Dürer (1471-1528), experimented with etching, but gave it up in favor of engraving.

In Holland Lucas van Leyden (1494-1533), etched a few plates of importance. They are the first examples of the use of copper for etching.

Nicolas Hogengerg of Munich (working 1523-1537) was the first artist to use etching with great speed and freedom.52

In the low countries the names of the men doing etching and engraving are comparatively unimportant up to the time of Peter Paul Rubens (1577-1640), Anthony Van Dyck (1599-1641) and Rembrandt Van Rijn (1606-1669). Their achievements are outstanding in different ways in the graphic arts. Rubens

51 Lippman, op. cit.

52 Popham, Alfred E., Graphic Arts, op. cit.
employed the technique of line-engraving. Van Dyck never quite mastered the technique of etching but still his drawings have a powerful conception. He also exerted much influence through his portrait engravings. Rembrandt's importance is in the great versatility of his genius. He did a great number of etchings in scenes concerning religion, "genre", still-life, portraits and landscapes.\textsuperscript{53}

It is in Italy that the potentialities of etching as an independent graphic medium first reached a realization. In the plates of Francesco Mazzuoli (c. 1503-1540) a new freedom is found. His etchings reached a great contemporary popularity and many artists tried their hands at the technique. Later the Spaniard Jose de Ribera (1585-1660) distinguished himself while working in Italy. In the eighteenth century Giovanni Tiepolo of Venice (1696-1770), etched with brilliance equal to his paintings.

In France, line engraving was the predominant means of graphic expression. Etching was used as a preliminary to the final engraving. Antonie Watteau (1684-1721), Francois Boucher (1703-1770) and Honore Fragonard (1732-1806) are among the outstanding men using this medium. Later all the painters of the "Barbizon" school used the etching needle.

Francisco Goya y Lucientes (1746-1828) shows the influence of Tiepolo in the etching medium although his compositions of the "Caprichos" and the "Desastres de la Guerra"

\textsuperscript{53} Lippman, \textit{op. cit.}
are extremely original in their satire.

Etching in England made no lasting contributions until the revival in the nineteenth century. It was then that James McNeill Whistler (1834-1903), an American by birth, executed his exacting compositions. Whistler’s brother-in-law, Sir Francis Seymour-Haden (1818-1910), exercised a direct influence on English etching after gaining inspiration from Rembrandt.

The first quarter of the twentieth century has been prolific with etchers of definite distinction. In America and Holland especially the interest has been intense. Some of them are: Henry Rushbury (b. 1889), Joseph Pennell, Gerald Brockhurst (b. 1890), an Englishman, Joseph Israels (1824-1911) and Mathijs Maris (1839-1917). 54

TECHNICAL PROCESS

The methods of producing etched prints and engraved prints from their plates are basically the same. The difference is in making the incisions in the plates. The metal engraving process will not be treated herein because of its similarity to woodcutting which has already been described.

The essential materials for producing an etching are:
1. a metal plate; 2. a ground or mordant resist; 3. a needle or point to cut the ground; 4. a mordant; 5. ink; 6. paper; 7. press. 55

54 Popham, Alfred E., op. cit.

55 Lumsden, E., Graphic Arts.
The metal plate may be either copper or zinc. The commercial copper plates that are cold rolled are very satisfactory. Zinc is softer and usually more porous, making the lines usually wider. Before applying the ground, the surface of the plate must be thoroughly cleaned with turpentine or any solvent.

The ground may be prepared by boiling together asphaltum, wax and pitch or mastic. After boiling several times it is poured into water to set. This mixture may be purchased ready made.

An easily made etchers needle is a recording machine needle pushed blunt-end foremost into a pen holder. Too sharp a point on a needle restricts freedom of movement.

After the drawing has been made on the waxed surface, the design is ready for biting. Two kinds of mordants that may be used to corrode the scratched lines are: 1. nitric acid mixed with an equal part of water; 2. iron perchloride. The latter bites more deeply and not so quickly.

The plate is placed in the acid bath only long enough to bite the most delicate lines. It is then taken out, washed with water, and carefully dried with blotting-paper. The biting is stopped by applying shellac varnish with a brush.

The ground and backing (if used) are removed and the proving begins. If the first proof is unsatisfactory, lines may be added or subtracted from the plate. A scrapper tool is used to remove unwanted lines or areas on the plate.

The etcher should do his own printing. Regular oil
printers' ink should be mixed with a palette knife to the proper consistency. The plate should be warm to keep the ink from hardening after it is applied with a dabber or roller. The excess ink is then wiped from the surface and the action known as "retroussage" is committed. Retroussage is done by delicately rubbing a soft rag over the surface so that the ink is raised and slightly blurred over the edges of the incisions. The plate is placed on the bed of press and the dampened printing paper on the plate. Place on top of this a clean sheet of blotting paper and a felt pad. Run the stack carefully through the press.56

PHOTOGRAPHY

The practice of photography depends on the sensitiveness of silver compounds to light. When silver bromide is blended with a gelatine and exposed to light it undergoes a change that enables it to become developable.57

Photography did not reach any acknowledged stage of development until the middle of the nineteenth century. Nevertheless certain phases of this process of optics and chemistry had been known for some time. At the site of Nineveh, a city destroyed about 1000 B.C., a lens was found which is now housed in the British museum. The Roman philosopher Pliny recorded the fact that yellow wax is bleached

56 Reed, Earl C., Etching A Practical Treatise.
57 Lape, John A., editorial director of Photography as a Career.
by exposure to sunlight.

The "camera obscura" was invented by an Italian philosophe named Baptiste Forte about the middle of the sixteenth century. It was a contrivance of the same principle as the plain box camera used today only on a much larger scale. However no reproductions were made with it.

The discovery of the chemical principles of photography has been attributed to several men. But Joseph Nicephore Niepce (1765-1830) was the first man to obtain a permanent photograph. This Frenchman, also the inventor of the velocipede and heliography, used various chemicals including silver chloride to obtain a vision on paper by using a cigar box as the camera.58

In 1838 a Frenchman named Louis Daguerre (b. 1787) developed and had publications made concerning his process for reproducing nature. His process called Daguerreotype and another process called Calotype acquired almost immediate recognition. From that time onward, much experimentation has provided rapid development in the process of photography.59

PROCESS

The whole procedure for producing photographic prints has been made extremely easy by the ready-made products put out by commercial manufacturing companies. Many kinds of cameras have been devised for various purposes. But on the


59 Ibid.
whole, the standard procedure is as follows in simplified form: 1. Preparation of the sensitive material for negatives, such as a coated glass plate or a film; 2. exposure of the plate or film in a camera; 3. development of the negatives, including fixing, washing, and drying; 4. preparation of the sensitive positive photographic paper; 5. development of the print including fixing, washing and drying.60

COMPARISON

Etching or engraving, as a multiple print process can hardly compare with photography as the latter is unlimited in the amount it is able to turn out. An etching plate on copper for example, is doing well to turn out three hundred prints.61 One hundred is considered of first quality.

Etching, as well as the other methods of incised line drawings, ceased to compete with photography as a means of illustration for recording purpose as soon as the photographic processes were perfected. During the present age photography is enlarging its field by leaps and bounds. Some of the main branches now using it to full advantage are: the amateur recorder, the commercial photographer, the motion picture industry, radiography (for medical purposes), applied photography (aerial photography, books, newspapers, etc.), stereoscopic photography and color photography. So extensive

60 Lepe, J. A., op. cit.

61 Lumsden, E., op. cit.
has been the commercial utilization that photography has had little chance to be recognized as an art. The designer's use is developing daily.
PHOTOGRAPH MADE WITH A
TORPEDO CAMERA SYNCHRONIZED
WITH TORPEDO DROPPING MECHANISM
CONCLUSION

This thesis has been devoted to the comparative analysis of techniques of representation on a flat surface. However a relationship of these techniques is felt to the expanding field of industrial design. Its application of old and new materials to suit the utility of the object is particularly significant.

In this field the artist must also be an engineer or work in cooperation with one. The central interest of the artist however is devoted to the surface treatment although he is vitally concerned with the observer's eye as it is led from place to place by the direction and weight of the masses.

Before Norman Bel Geddes opened the first industrial-design studio in 1927, no research along this specific line had been explored or exploited to any great extent. Some of the men who soon followed are Walter Teague, Joseph Sinel, Henry Dreyfuss, Raymond Loewy and George Sakier. Many of these men are specialists while others keep their studios open to the general field, but all of them are concerned with industry and the reaction of the public mind. Architects have invaded the field where everything from alarm clocks to ships and telephones to building interiors have gone through an evolution of redesigning.62

With such vast experimentation being carried on, the techniques of representation herein described may seem tri-

flying and insignificant. However the author believes that, just as the older techniques acted as a basis for experimentation for the new techniques, these newer methods and their chemical factors will play an important part in future developments. Particularly pertinent to this subject is the development of strong, synthetic products such as plastics. Harold Van Doren, a technically sound artist, has been a leader in designing in plastics, specially applying to them the scientific principles of modern color.\textsuperscript{63} Closer to the realm of fine arts, studies made by Picasso, Archipenko and the neo-plasticists have been initiated in nearly every possible material.

There are other important developments to consider in the modern application of flat surface representation. Since the invention of the electric light, a use of it has been applied wherever sunlight is not available or wanted. A special branch of electrical engineering has been devised called, "Illumination Engineering."\textsuperscript{64} Colored lights have been substituted for surface paint in advertising, certain phases of architecture and particularly to stage design. Photography too would be at a great loss without the assistance of artificial lighting.\textsuperscript{65}

The problem of introducing new materials and techniques

\textsuperscript{63} Ibid.

\textsuperscript{64} Boast, W. B., \textit{Illumination Engineering}.

\textsuperscript{65} Stair, J. L., \textit{The Lighting Book}.
to the student is largely a concern of expense and the knowledge of the teacher. The author is of firm belief however that any new experimentation should be based on technical findings of the past. Thus the old methods of representation on level surfaces should continue to throw a guiding light on education through art.
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