ART TOOLS AND MATERIALS SUITABLE FOR MANUFACTURE

IN THE SCHOOL OR HOME LABORATORY

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ART TOOLS AND MATERIALS SUITABLE FOR MANUFACTURE IN THE SCHOOL OR HOME LABORATORY

THESIS

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CHAPTER I

INTRODUCTION

The Problem

The cost of supplies necessary for carrying out a satisfactory high-school art program prompted the inquiry into the potentialities of native materials for manufacture of art tools and media by amateurs. It is the thesis of this study that the production of many art tools and materials in the school or home laboratory is feasible, and that it would not only reduce the cost of a school art program but also enrich it. The experiments performed in support of this thesis are presented in this report.

Sources of Data

The published data for this study came from books on art materials and from artists' reports on the manufacture of tools and media. First-hand information was derived from experiments with native materials.

Scope of Experiments

The problem was limited to the testing and manufacturing of art tools and media that might be suitable for a secondary-school art program, with further limitation to

the area of drawing and painting. The experiments were confined to the production of drawing and painting surfaces, pigments and pigment media, and brushes and pens.

Procedure

Methods of processing and manufacturing tools and media were obtained from historical data, including the reports of artist-craftsmen. Then, experiments were conducted--first, as nearly as possible, according to the artists' directions; and second, with the substitution of various native materials or present-day techniques, to see if a simpler method or a better product could be obtained. The experiments were tested and evaluated as to cost, simplicity, and practicality; and those requiring expensive materials and equipment or lengthy processes were eliminated, even though the end product was satisfactory.

The presentation of the report by chapters is as follows: Chapter I, Introduction; Chapter II, Drawing and Painting Surfaces; Chapter III, Pigments and Pigment Media; Chapter IV, Brushes and Pens; Chapter V, Conclusion.

CHAPTER II

DRAWING AND PAINTING SURFACES

Paper

History of Paper Manufacture

The origin and early history of paper are obscure. Chinese sources state that paper was first made by Ts'ai Lun (Tsai Loun) in 105 A.D.[1]

The manufacture of paper was well established in Europe in the twelfth century, resulting in the displacement of parchment. Machine-made pulp paper appeared at the end of the eighteenth century, displacing the handmade rag product for less important work; however, handmade rag paper continues to be produced commercially. One method still used was described by a British paper manufacturer twenty-five years ago:

> The pulp after being prepared in the beating engine is run into large chests from which the vat is supplied; before reaching this it is strained on the paper-machine. The sheet of paper is made on a mould of fine wire-cloth with a removal frame of wood to keep the pulp from running off, extending slightly above the surface of the mould, called the "deckel." To form the sheet, the paper-maker dips the mould into a vat containing the prepared pulp, lifting up just so much as will make a sheet of the required thickness; as soon as the mould is removed from the vat, the water begins to drain through the wire-cloth and to leave the fibres on

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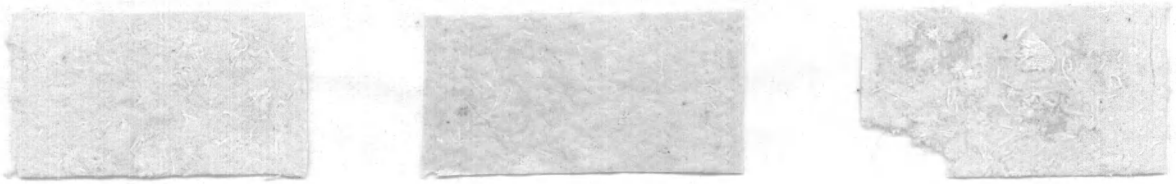
[1] Dard Hunter, Paper-Making in the Classroom (Peoria, 1931), p. 19.

> the surface in the form of a coherent sheet, the felting or interwining being assisted by a lateral motion or "shake" given to the mould by the workman; the movable deckel is then taken off, and the mould is . . . [turned over and pressed] against a felt, by this means transferring or "couching" the sheet from the wire to the felt. A number of sheets thus formed are piled one above another alternately with pieces of felt, and the whole is subjected to strong pressure to expel the water; the felts are then removed and the sheets are again pressed and dried, when they are ready for sizing.[2]

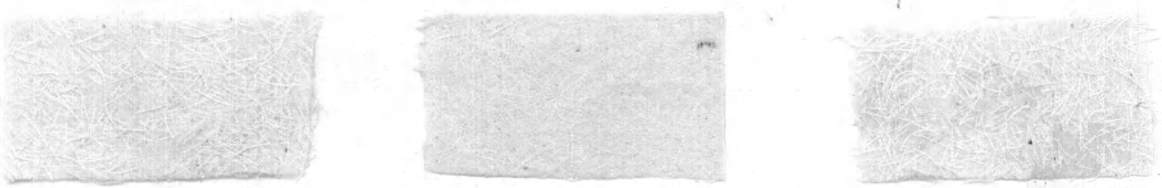
Paper-Making in the Laboratory

Cotton and linen papers.---Papers made from cotton and from linen rags were attempted. Through experimentation, a process which produced a good grade of paper from each kind of fiber was evolved. (See Figures 1 and 2.)



A B C

Fig. 1--Sample of paper made of cotton rags, showing (A) right side, unsized, (B) right side, sized, and (C) wrong side.



A B C

Fig. 2--Sample of paper made of linen rags, showing (A) right side, unsized, (B) right side, sized, and (C) wrong side.

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[2] Encyclopaedia Britannica, 13th ed., XX (New York, 1926), 732.

The following materials needed for the experiment were collected: cotton and linen rags, gelatine, alum, a screen wire and frame, felt sheets, a large tub, and a meat grinder.

Clean white rags were cut into three-inch squares and were soaked in water overnight. A hand-operated meat grinder was used to macerate the wet rags. The cutting disk was screwed on loosely enough to keep the fibers from completely losing their identity. All lumps in the resulting pulp were eliminated with the fingers or put through the grinder again until they were gone. The whole grinding process was repeated. The pulpy mass was tested by stirring a small amount in water. It was found that the mass formed a consistently creamy substance, indicating that it had been ground enough. In several trials, during which the fibers were ground too much, the creamy substance did not result, and the resulting fibers did not mat to make paper. The strength of paper depends upon the length of its fibers--the longer the fibers the stronger the paper.

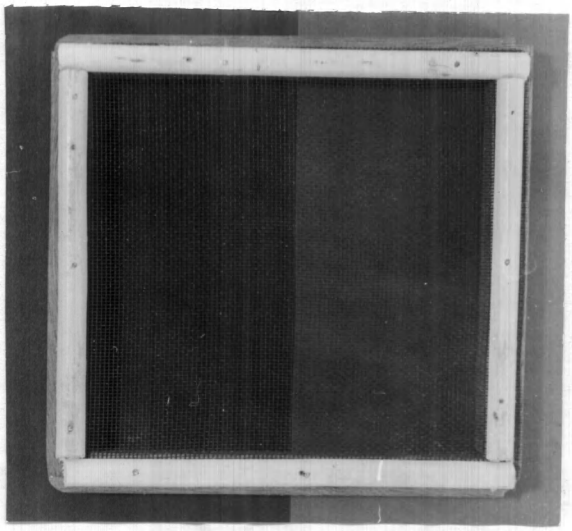


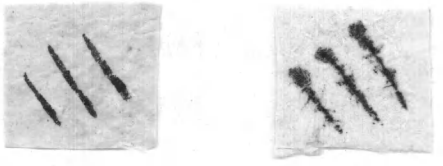
Fig. 3--Mold for making paper

A mold, 7 inches long by 7½ inches wide by ¾ inch high, used to form the pulp into sheets of even size and thickness, consisted of a wooden rectangular frame enclosing a piece of screen wire. (See Figure 3.) A molding was placed around the frame with its upper edge 1/16 inch higher than the screen wire. It retained the fibers and allowed the water to drain through. The mold was dipped perpendicularly into the tub containing rag pulp and water, turned while submerged, and brought up horizontally, which allowed the water to sieve through the wire. The mold was gently shaken from left to right, and forward and back. This movement caused the fibers to mat and cross, and also aided in the draining process. The mold was finally turned so that the surplus water drained from one corner, thus leaving the wet sheet flat and undisturbed. The molding, or deckel, was removed and the mold was held with both hands. The edge of the mold, held by the left hand, was placed against one of the pieces of felt, and the wet pulp sheet was deposited with a rolling motion onto the felt. The mold was lifted off and the sheet was covered with another piece of felt. This process was repeated until the desired number of sheets had been stacked. The stack was then placed between two boards in a printer's hand press. (This process will take as much pressure as can be applied, so there is no fear of too much pressure; the problem is to

get enough pressure.) The pressure matted the fibers of the sheets. The felts were removed, and the sheets were stacked bare. After standing for an hour or so, they were pressed again; this pressing gave a finish to the papers. They had stuck together but were allowed to remain thus in groups of three to prevent curling while drying. Afterward they were separated and laid out singly to dry.

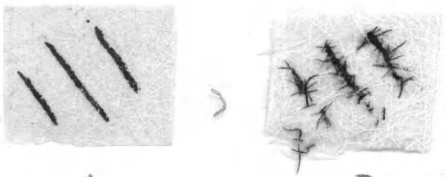
Sizing the paper.--If paper is to be used for ink drawing, it should be sized so that it will not blot. For the sizing, a package of gelatine was dissolved in a pint of boiling water, and a fourth-teaspoonful of alum was added to prevent spoilage of the gelatine. The sheets of paper were dipped into this warm solution and dried.

Testing the paper.--Sheets of both kinds of handmade papers were tested by handling the paper to see if the fibers had matted so that they would hold together as a single piece. Brush strokes were applied to the sized and unsized surfaces of each to see if a desirable sheet for classroom art work had been made. (See Figures 4 and 5.)



A B

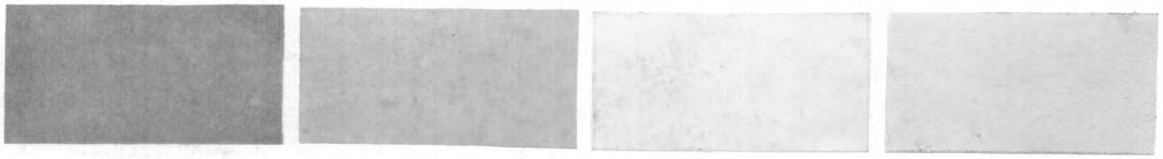
Fig. 4--Brush stroke test on cotton paper: (A) sized and (B) unsized.



A B

Fig. 5--Brush stroke test on linen paper: (A) sized and (B) unsized.

Evaluation of experiments.--The paper made from linen rags was of a better grade than that made from cotton rags. The linen fibers made a better-knit and more compact sheet. The surface texture of the linen sheet was smooth, while that of the cotton was coarse. (See Figures 1 and 2, page 4.) The cotton-rag paper would prove satisfactory for art work when a textured paper is desired.



A B C D

Fig. 6--Samples of tracing paper made with (A) linseed oil, (B) vegetable shortening, (C) hair oil, and (D) cold cream.

Making of Tracing Paper in the Laboratory

Introduction.--Paper which is to be used for tracing purposes must be smooth, thin, and white. An oil film must be applied to the paper surface. The four kinds of oils that were used in this experiment were vegetable shortening, hair oil, cold cream, and linseed oil.

Description of experiments.--The experiments performed in an attempt to produce a tracing paper of good quality were based on directions given by Cennini:

> . . . tracing paper which we have been discussing may be made out of paper, the paper, to begin with, being made very thin, smooth, and quite white. Then grease

> this paper with linseed oil, and with a soft brush lay a coat of it all over. And let it dry for two or three days, and it will be good tracing paper. It becomes transparent and it is good.[3]

By following this method, a satisfactory transparency was achieved using typewriter-bond paper. The substitution of vegetable shortening, hair oil, and cold cream for linseed oil was also attempted. Likewise, experiments were performed with substitutes for the brush--a soft cotton rag and direct application with the hands.

Evaluation of experiments.--Good sheets of tracing paper were made with all of the oils or fats used. It was found that the tracing paper made with linseed oil turns yellow with age; however, since tracing paper is used only as an aid in producing a finished product, all papers made were found to be satisfactory and suitable for classroom manufacture. (See Figure 6.) All three methods of application proved equally satisfactory.

Making of Pastel Papers in the Laboratory

Introduction.--Paper which is to be used as a surface for pastels must have a tooth to it or a rough texture. An abrasive material must be permanently affixed to the paper surface.

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[3]Cennio Cennini, Craftsman's Handbook (New York, 1933), p. 14.

Since paper of this type is expensive and difficult to obtain, unless the area is large enough to have an art store, experiments were performed using different types of paper, adhesives, and abrasives, which would be suitable for classroom projects.

Four kinds of paper products were used in the experiment. Corrugated cardboard, pulpboard, butcher paper, and mechanical-drawing paper were selected since their characteristics ranged from a stiff and sturdy type to a flexible and semi-durable type.

Two kinds of abrasives were used--silica or sand and powdered pumice-stone. The choice of these two gave a fine- and a coarse-grained texture with which to work.

Lacquer, oil varnish, mucilage, and Elmer's Glue-All were used to adhere the abrasives to the papers' surfaces.

Description of experiments.--The section of the paper to be treated was thinly coated with the adhesive. It was applied thinly so as not to leave brush marks--it may be applied with the palm of the hand or a sponge. While the surface was wet, a fine abrasive was sprinkled onto the surface. The adhesive was allowed to dry hard, and then the paper was tapped lightly to remove the excess abrasive.

The paper was then subjected to trials, the first being the rubbing of the fingers and hands over the surface to test the adherent quality of each adhesive. After

testing the adherent quality of the paper, the surface of the paper was checked for curling and warping as undesirable traits. The final test was using a pastel crayon on the various types of treated surfaces. (See Figures 7 and 8.)

Evaluation of experiments.--Corrugated cardboard was found to be an excellent paper to use as it was sturdy, did not curl or warp, and did not require attachment to a drawing board while being used. It was found to be the most accessible material tried and yet the strongest, which makes it ideal for school use in art work.

Pulpboard, as found in laundered shirts, also proved to be sturdy. This, however, required the support of a board or a stiff surface while being used.

Heavy butcher paper had the advantage only in that it may be rolled up for storage or carrying, as was also true in the case of the drawing paper.

Elmer's Glue-All proved to be the strongest of the glues used and more economical than the paint group. It was cleaner to use as it required nothing but water to wash the brush and hands after its application.

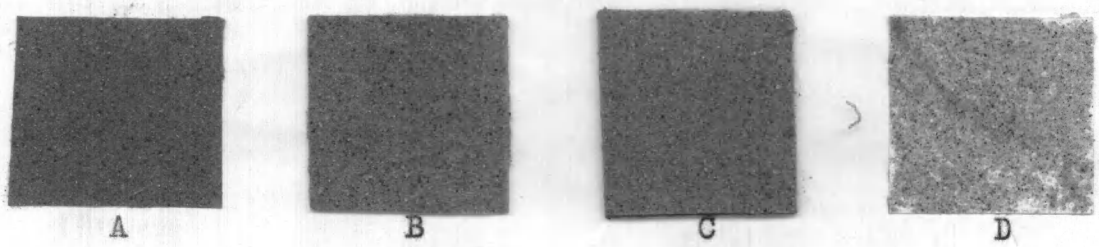

Fig. 7--Samples of treated surfaces for pastels, using Elmer's Glue-All with sand on (A) butcher paper, (B) pulpboard, (C) corrugated cardboard, and (D) mechanical drawing paper.

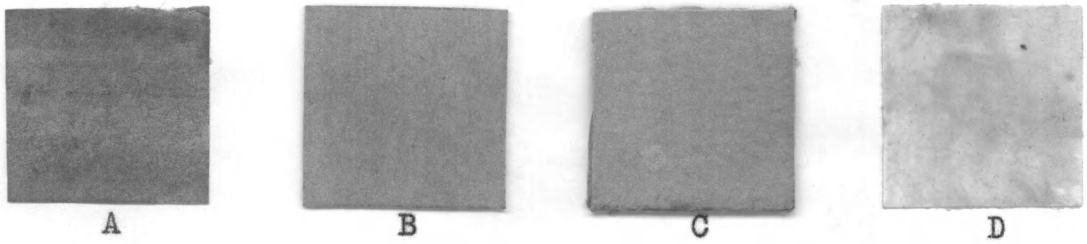

Fig. 8--Samples of treated surfaces for pastels, using Elmer's Glue-All with powdered pumice stone on (A) butcher paper, (B) pulpboard, (C) corrugated cardboard, and (D) mechanical-drawing paper.

Canvas

History of Canvas as a Painting Surface

The early use of a cloth for a painting surface may be dated back to the Egyptians, who painted faces on the linen-wrapped mummies. The Greeks' use of cloth as a painting surface is obscure. Unlike the Egyptians, the Greeks had little regard for the preservation of works of art. There are a few records telling of the easel painting methods, but there are no known existing examples of this work. It was the Romans, of medieval Europe, who left the best records concerning the use of stretched cloth as a painting surface. Theirs is the earliest known use of painting on cloth stretched over wooden frames. Such banners were used in religious street processions.[4]

Experiments in Preparation of Canvas

Cennini's method.--An early method for preparing canvas as described by Cennini was:

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[4]R. Mayer, Artist's Handbook of Materials and Techniques (New York, 1933), pp. 11-14, 203.

> Now let us speak about how to work on cloth, that is, on linen or on silk. And you will adopt this method for cloth: in the first place, stretch it taut on a frame, and begin by nailing down the lines of the seams. Then go around and around with tacks, to get it stretched out evenly and systematically . . . first put on an all-over coat of size without any gesso. And it would not matter if the size were not as strong as for gesso, and, with a blunt soft bristle brush. . . . Then, when it is dry, take the cloth; take a knife blade which is even on the edge, and as straight as a ruler; and lay some gesso on the canvas with this edge, putting it on and taking it off evenly, as if you were scraping it down. And the less gesso you leave on, the better it is; just so you fill up the interstices between the threads. It will be amply sufficient to put on one coat of gesso. When it is dry take a penknife which scrapes well, and look over the cloth to see whether there is any node or knot on it, and get rid of it. . . .[5]

Mayer's method.--A contemporary method of preparing canvas, as suggested by Ralph Mayer, is:

> Stretch the linen, driving the tacks only part way into the stretcher, and moisten the canvas evenly with water. When it is dry, tighten and restretch permanently. Impregnate the canvas thoroughly with size. Oil paint should never come in direct contact with the fiber, or the canvas will rot. . . . When the size is dry, apply the priming with a brush in even coats, as thinly as possible. Work the paint well into the cloth; use a scraper to remove excess of first coat if necessary, the idea being to apply as thin a coat as possible. The scraper is a tool with its edge at the end, similar to a very wide putty knife; it is commonly called a wall-scraper. . . . Canvas for oil painting is commonly prepared by the application of two coats the second being applied thinly and carefully as soon as the first is dry enough. Most commercial primings are tinted slightly grayish to overcome a tendency toward yellowing.
>
> Aqueous grounds also require a preliminary sizing of the fabric if they are to be applied successfully. The usual preferred sizing material is hide glue but

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[5]Cennini, p. 103.

> diluted with water so that it forms the weakest sort of semi-jelly. Casein and other animal glues of good quality may also be used, but they too should never be made up in strong or adhesive concentrations. . . . A size is not a cement; it is a penetrating liquid employed to fill pores, to isolate coatings or to make surfaces suitable to receive coatings; it is not intended to form a continuous, level film. This is an important distinction, and one not always realized. . . . Direct application of oil to linen, definite and inevitable as its rotting effect may be, is no more ruinous to an oil painting than a heavy film-forming coat of glue or casein.[6]

Modified method.--Using Cennini's method of stretching canvas and Mayer's method of priming, the following experiments were tried:

The fabrics used were cotton ducking, the underside of oilcloth, and linen. The primers used were casein, alkyd flat enamel, and lead-base undercoat.

Each fabric was stretched as tight as possible and was tacked to a wooden frame, using household canvas tacks.

The fabric was then primed with one of the primers. A putty knife was used to apply and scrape off the excess primer. Each was allowed to dry two days before the second coat was applied. The tacks were removed. The canvas, being held to the light, was checked for light seepage and thinly coated areas. These were corrected with a repeated priming. When dry, the canvas was ready to be cut and fitted to a desired stretcher for painting.

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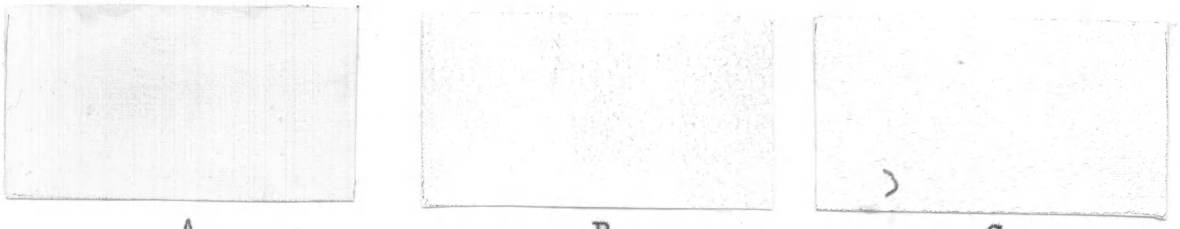
[6]Mayer, pp. 204-206.

Testing the surface.--Mayer, as well as Laurie, recommends working the treated canvas between the hands to see whether the priming is firmly attached. Any ground can be made to crack by folding it sharply, but the strength of coatings and their degree of adhesion can be judged by a slight fold.[7]

Evaluation of Experiments

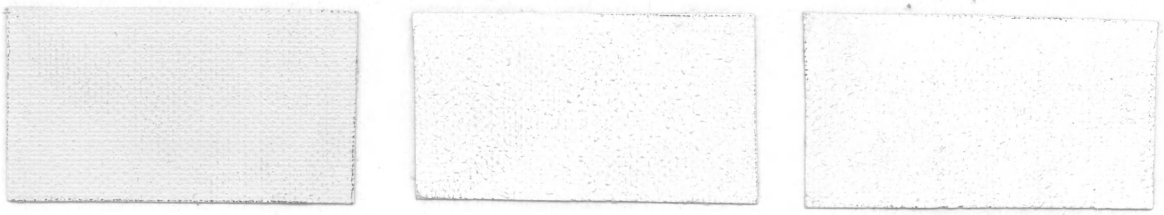
Each fabric when treated with each primer made a desirable temporary surface on which to paint. A durability test is impossible to evaluate at this time. Each had a desirable texture and made a good grade of canvas for practice and quick sketches. Of the three primers used, casein was the easiest and least expensive to work with as it is water soluble; therefore, it was easy to clean up the tools used in the application and also the hands. The other two required turpentine for thinning and for cleaning the tools and hands. Other than in economy, the other two primers used equaled casein. (See Figures 9, 10, and 11.)



A B C

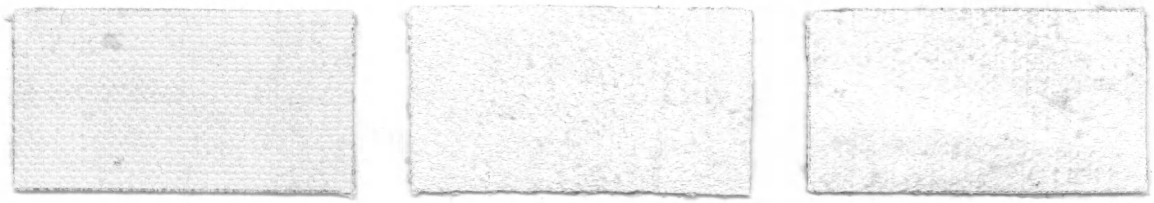
Fig. 9--Samples of linen treated for use as canvas with (A) casein, (B) alkyd flat enamel, and (C) lead base undercoat.

[7] Ibid., p. 212.



A B C

Fig. 10--Samples of oilcloth treated for use as canvas with (A) casein, (B) alkyd flat enamel, and (C) lead base undercoat.



A B C

Fig. 11--Samples of ducking treated for use as canvas with (A) casein, (B) alkyd flat enamel, and (C) lead base undercoat.

Wood

History of Wood as a Painting Surface

Wood as a basis for painting has been used from very earliest time. Early man painted on bark, tree limbs, driftwood, and slabs of wood.

In Germany, during the Gothic period, wood was proved effective as a good base for painting. The Germans primed the wood on both sides. They topped that with a good coat of paint on the back, as recommended in old Italian recipes. They also found that cooking the wood in oil served very

little purpose in preparation, as blisters developed under the influence of heat.[8]

Experiments in Preparation of Wood

Cennini's method.--An Italian method of treating wood, as stated by Cennini, was:

> Now we come to the business of working on anconas or on panel. To begin with, the ancona should be made of a wood of good quality. . . . And first . . . see whether there are any rotten knots; or, if the board is greasy at all, have the board planed down until the greasiness disappears; for I could never give you any other cure. See that the wood is thoroughly dry. . . . Let us just go back to the knots or nodes, or other defects which the panel may display. Take some strong leaf glue . . . then have some sawdust wet down with this glue in a porringer. Fill the flaws of the nodes with it, and smooth down with a wooden slice, and with the surrounding level. Look it over again; if there is a bud sticking through the surface, beat it well down into the board. . . . First take a size . . . [and] apply this size to your ancona . . . using a large soft bristle brush. Then let it dry. Next take some of your strong size, and put two coats over this work with your brush; and always let it dry between one coat and the next; and it will come out perfectly sized.[9]

Mayer's method.--Another method, as suggested by Mayer, for preparing a wooden surface for painting was:

> After the selection and preparation of a support for the panel, the next operation is to coat the panel with several layers of a white gesso. Gesso is a plastic or liquid material applied as a coating to surfaces in order to give them the correct properties for receiving painting, gilding, or other decoration.

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[8]M. Doerner, Materials of Artists (New York, 1934), pp. 33-35.

[9]Cennini, pp. 69-70.

> It is made by mixing an inert white pigment such as chalk, whiting, or slaked plaster of Paris, with an aqueous binder such as a solution of glue, gelatin, or casein. Gesso may also be built up, molded or modeled into relief designs, or carved. Aside from its use in preparing flat surfaces or grounds for painting, it is employed in the decoration of picture frames and furniture, and to a lesser extent as a medium for modeling. When finally dry, its surface is normally sandpapered to a smooth, ivory-like finish.[10]

Modified method.--Using Cennini's method of sizing and Mayer's method of applying gesso, an experiment of making a painting surface on wood was tried--the wood, however, being the contemporary plywood variety.

Plywood was used because it has many advantages over ordinary lumber. It is stronger, in most instances, than a single board of the same thickness, and it is less likely to shrink, check, or warp.[11]

Testing the surface.--The surface was inspected for pinholes, caused by air bubbles during the applications of gesso. These had to be sanded down when present. Next was the checking of any cracking, peeling, or blistering. (This requires around two weeks; if none of these appear, it is safe to assume that these defects are not present.) Also, it was checked for crackle, which is caused from an

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[10]Mayer, p. 220.

[11]George Stout, Painting Materials--A Short Encyclopaedia (New York, 1942).

over-diluted binder in the gesso, while a heavy, concentrated binder causes cracking and separating from the wood and support.

Evaluation of Experiment

A satisfactory surface was made using gesso over a sized piece of plywood. (See Figure 12.) It is too early, however, to report upon its durability.

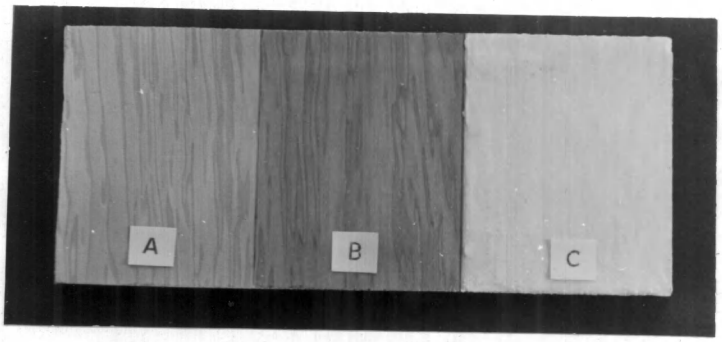

Fig. 12--Treated wood for oil panels showing steps (A) unsized, (B) sized, and (C) gesso-applied surface.

It was found that the use of steel wool, after the gesso had been sanded, made the surface much smoother and more desirable. This is a rather simple process that could easily be carried out in the school or home workshop.

CHAPTER III

PIGMENTS AND PIGMENT MEDIA

Charcoal

History of Charcoal as a Pigment Source

Charcoal has been used since very early times as a source of black pigment. The oldest known paintings made by man are to be found in caves of southern France and Spain. The pigments used by these early men, who worked at least 20,000 years ago, were colored clay and charcoal. The latter came from soot or charred bones, which were mixed with a binder of bone marrow and urine.[1]

The African Bushmen, as well as the ancient Egyptians, used pulverized charcoal in making black and grey paint.[2]

The early Greeks, who had only four colors--red, white, yellow, and charcoal black--mixed yellow with powdered charcoal to produce a greyish-green tone.[3] The Italians used charcoal as a sketching medium in laying out compositions to be painted on canvas and on wooden panels.[4] Not only in the Occident, but also in the Orient the early

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[1]Charles Moreau-Vauthier, The Technique of Painting (London, 1912), p. 2.

[2]Ibid., p. 3.

[3]Ibid., p. 7.

[4]Cennini, p. 75.

use of charcoal as an art medium is recorded. In 2697 B.C. the Chinese made ink by mixing charcoal or soot with a watery solution containing gum or glue.[5]

Modern Uses of Charcoal as an Art Material

Coals from charred wood, which is nearly pure carbon, are used in their natural stick form for drawing purposes; in a powdered form mixed with water, as a gouache to be applied with a brush; and as the pigment mixed with talc, clay, and gum to form a pastel stick.

Description of Experiments

Cennini's method.--In 1437, Cennio Cennini described two methods then in use by artists for making charcoal:

> Take a nice, dry, willow stick; and make some little slips of it the length of the palm of your hand, or, say, four fingers. Then divide these pieces like match sticks; and do them up like a bunch of matches. But first smooth them and sharpen them at each end, like spindles. Then tie them up in bunches this way, in three places to the bunch, that is, in the middle and at each end, with a thin copper or iron wire. Then take a brand-new casserole, and put enough of them to fill up the casserole. Then get a lid to cover it, [luting it] with clay, so that nothing can evaporate from it in any way. Then go to the baker's in the evening, after he has stopped work, and put this casserole into the oven; and let it stay there until morning; and see whether these coals are well roasted, good and black. . . . I will give you another method for making these coals: take a little earthenware baking pan, covered as described above; put it under the fire in the evening, and cover this fire well with ashes; and go to bed. In the morning they

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[5] Encyclopaedia Britannica, XIV, 571.

> will be roasted. And you may make big coals and little ones in the same way; and make them to suit yourself, for there are no better coals anywhere.[6]

Modified method.--By following Cennini's directions, very satisfactory results were obtained by each method; however, the second method, with the substitution of tin cans for the earthenware casserole and the wrapping of the bunches of twigs in aluminum foil to cut down oxygen, produced an excellent product that can be made with little difficulty by artists and students. (See Figure 13.)

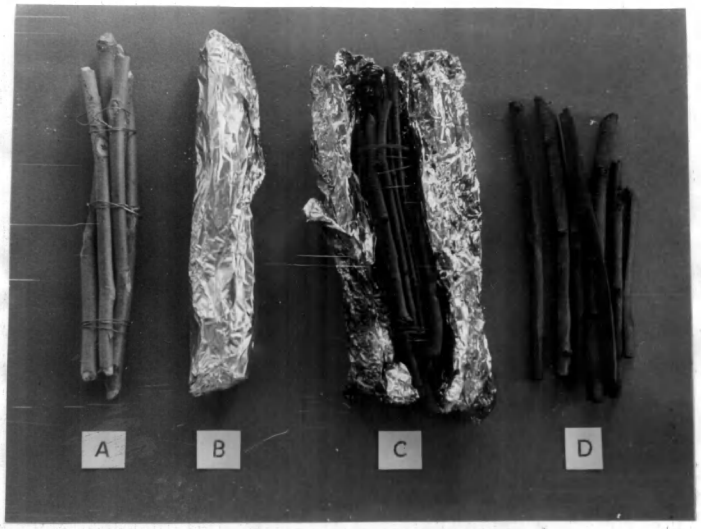

Fig. 13--Four steps in making of charcoal: (A) unfired bundle; (B) foil-wrapped bundle; (C) fired bundle, and (D) charcoal sticks.

The needed materials were: twigs of desired size to be charred; a hoe; four bricks; a large pan or metal barrel;

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[6]Cennini, p. 19.

tin cans for holding twigs; clay; aluminum foil; thin, flexible wire; and firewood.

The twigs were prepared by cutting off the buds and knobs, and were ¼ inch to 1½ inches in diameter and 4 to 5 inches long. The larger twigs were split into quarters lengthwise. Then four to six of these strips were bound together with floral wire in the middle and on both ends. Each bundle was wrapped in foil. The wrapped bundles were placed in two tin cans of the same size--about three or four bundles to a can, depending upon the size of the cans. The bundles were of such length and number that the open ends of the cans could be joined. A collar of clay was placed around the rim of one can and the second can was placed over it. The lips of the cans were pressed together and the clay was smoothed to make an air-tight chamber for the bundles. (The less oxygen there is in the chamber the better the charcoal will be.)

The pit for charring the wood was prepared by digging a trench 1 foot by 2 feet by a foot or so in depth. Bricks were laid in the bottom of the pit and a fire was built. When the fire had burned down, leaving a pit of live coals, the hoe was used to dig a place in the coals big enough for the cans, but a two-inch bed of coals was left underneath the cans which were covered with the live coals. A second fire was allowed to burn for twenty to thirty minutes, and

then the fire was covered with the metal barrel or pan. The cover must have a small opening for smoke escapage. The fire smoldered until it died. It smoked for about four to six hours. It was allowed only to smoke, not burn or die. The next day the cans were dug up, and a good grade of drawing charcoal was found within.

Tests using the charcoal for drawing, making ink, and as a base for pastels were performed. The charcoal in all three cases proved to be satisfactory.

It was first tested for drawing. (See Figure 14.) The strength of the stick and the quality of line made were found to be very satisfactory.

Fig. 14--Marking test using charcoal.

Evaluation of Experiments

Excellent results were obtained from the use of the contemporary items, tin cans and aluminum foil. The advantage in substituting these items for Cennini's casserole was that this eliminated the chance of breakage in two of

his steps--the heating-up stage of the casserole and the cooling-off stage--since a too sudden change in temperature can cause a ceramic container to crack. Oxygen thus admitted would ignite the twigs, thereby turning them to ashes.

Ink

History of Ink as a Drawing and Painting Medium

The ancient Egyptians and Chinese began making a carbon ink at about the same time and in about the same way. Ink-written characters as old as 2500 B.C. were found on an Egyptian papyrus; in China, between 2697 B.C. and 2597 B.C., ink was accredited to Tien-Tcheu. These early inks were made from charcoal, soot, or carbon obtained from burning certain types of wood or oil in a scanty supply of air and then mixing them with gum, glue, or varnish.[7]

Two early Roman inks were obtained from the sea; one was made from the black pigment secreted by the cuttlefish and the other from Tyrian purple dye which was made from crushed shells of a shellfish. The latter ink was by decree for the Emperor's use only.[8]

Neither the inks of China and Egypt nor the ones made from cuttlefish and shellfish bear much relation to the

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[7] Encyclopaedia Britannica, XIV, 571.

[8] Carroll Gard, Writing Past and Present (New York, 1937), p. 53.

inks of today, which are made of chemical compounds. The first description of an ink of this kind was recorded by a monk in the eleventh century A.D., but it had been used long before that time.[9]

Modern Uses of Ink as an Art Material

Ink mixed with water, for making a wash; a waterproof ink for drawing, for superimposing a water-color tint after the ink has dried; indelible ink, for marking materials which are subject to frequent washing; and copying ink, for printing purposes are only a few of the many inks on the market today that may be used as an art material.

Description of Experiments

Charcoal as a pigment source.--Pulverized charcoal or soot mixed with gum or glue and water, called China or India ink, was an ancient method of preparing ink which is still being made in China and Japan.[10]

The materials needed in trying out this process were: charcoal, gum-arabic, and water. A mortar and pestle were the tools needed.

An adhesive was prepared by adding one tablespoon of gum-arabic to a pint of water. The charcoal was pulverized with the mortar and pestle. The liquid adhesive was slowly

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[9] Ibid., p. 53.

[10] Encyclopaedia Britannica, XIV, 571.

added to the ground charcoal and stirred. Tests for strength from time to time were made as the adhesive was added, to ensure a strong color of ink.

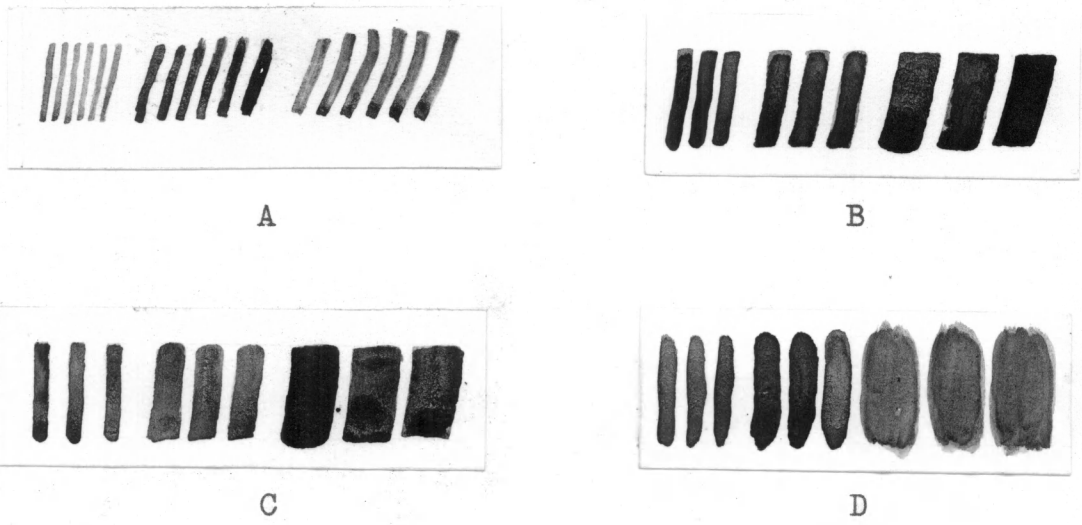
Tests using quill pen points, cane and bamboo pen points, and brushes were run on the ink for its strength, flow ability, and suitability for use as a wash. (See Figure 15.)

Pokeberries as a pigment source.--An experiment was performed using the deep wine-colored berries of the pokeweed as the coloring matter for ink.

The needed materials were: pokeberries, gum-arabic, and water. A mortar and pestle were the tools needed.

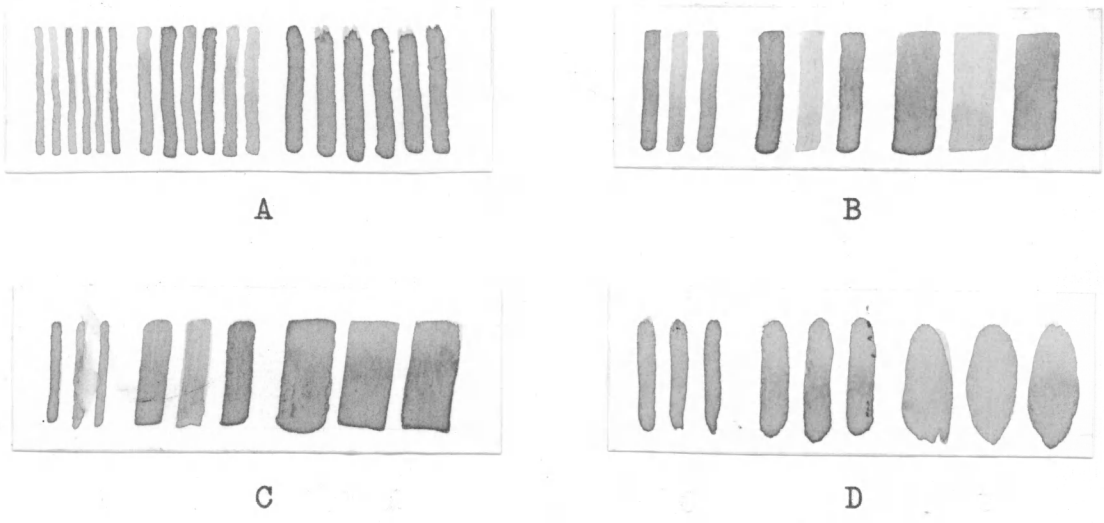
An adhesive was prepared--one tablespoon of gum-arabic to a pint of water. The berries were pulverized in a mortar with a pestle. The liquid was drained from the berries into a container. The adhesive was stirred slowly into the container to get the desired strength of color. Tests for strength were made from time to time as the adhesive was added.

The ink was then placed through a series of tests. Quill, cane, and bamboo pen points were used to test the suitability and strength of the ink for writing. A brush was used to test the ink for drawing. (See Figure 16.)



A B C D

Fig. 15--Samples of charcoal ink lines using (A) quill, (B) bamboo, and (C) cane pen points; and (D) brush.



A B C D

Fig. 16--Samples of pokeberry ink lines using (A) quill, (B) bamboo, and (C) cane pen points; and (D) brush.

Evaluation of Experiments

Satisfactory inks were obtained with both charcoal and pokeberries.

Charcoal had the advantage over pokeberries in that charcoal is obtainable the year round while pokeberries are only obtainable in the fall. The color of charcoal ink was more desirable than the purple of the pokeberry; also, the purple of the pokeberry tends to fade and turn brown with age.

Pastels

History of Pastels as a Painting Medium

The origin of pastels is obscure. Thiele of Erfurt, who lived from 1685 to 1752, is said to have been the inventor. Two Danzig artists, a Madame Vernerin and Mlle. Heid, also claimed the invention. Rosalba and La Tour's use of pastels helped to bring about their popularity in the eighteenth century.[11]

Modern Uses of Pastels as an Art Material

Oil, beeswax, or paraffin added to pastels will make another form of crayon--the common "crayola" used by elementary-school pupils. Some contemporary uses of pastels are: for shading or highlights in architectural sketches, in sketching subjects for later rendering in oils, and as a medium or in mixed media for advertising layouts and for book illustrations.

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[11] Encyclopaedia Britannica, XX, 890.

Description of Experiments

Ostwald's method.--A method of making pastels for artists, as given by Ostwald, is:

> In one container place one-third oz. gum-arabic. Add one pint of water and allow to set over night. Add a little beta naphthol to prevent spoiling. Get three bottles and mark them A, B, and C respectively. In bottle A pour one-third of solution plus an equal amount of water; and bottle C pour three parts water to the remaining one-third.
>
> Next take 2 oz. of chalk and add a ½ oz. of the dilute C solution, described above. Mix this in the mortar until it is smooth and of the consistency of putty. If it is too dry and stiff add a little water, and if it is too liquid add more chalk. Roll into sticks with the hand on a layer of newpaper. Allow to dry in a warm (not hot) place.
>
> To make a series of gradations of a color--ultramarine, for example--first make a large amount of the white chalk paste to be used as stock. Then take about 2 oz. of ultramarine and grind it to a smooth paste in the mortar with a sufficient amount of the medium-strength solution B. Make crayons of this paste; they will be the first or deepest shade of ultramarine. Before the crayons are molded, a small piece should be dried and tested to see whether it is of the desired degree of softness. If any alterations in the strength of the gum solution are necessary, make a note of them for future reference.
>
> Repeat the foregoing operation with another 2 oz. of ultramarine mixed with the proper amount of binding solution, divide the dark blue paste into two equal portions, and return one portion into the mortar; add to it an equal volume of the white stock, and grind thoroughly until the mixture is uniform and free from spots and streaks. This mixture, when made into pastels, will give the second value, ½ blue and ½ white.
>
> Divide the remaining dark blue paste, and to half of it add three parts of the white stock, making the same total quantity as was produced before. Pastels so made will be the third value, ¼ blue, ¾ white. Continue dividing the remaining blue mass in half and making it up to the same total amount each time with chalk paste. Between the seventh and tenth steps, depending on the strength of the ultramarine, the

> color will become so light that further dilution produces no noticeable difference, and the series is finished.[12]

Modified method.--Following Ostwald's directions, pastels were produced; however, it was decided to substitute natural-colored clays, found in the immediate area, for the commercial pigments.

The needed materials for the experiments were: native clays and Athens or any commercial white clay, gum-arabic, and sugar. Also needed were mortar and pestle, crockery or other container for soaking the clay in water overnight, screen wire or sieve, and scales or other device for measurement.

The crayons were prepared as follows: the native clay was broken up into smaller particles, placed in a crockery bowl with water, and allowed to soak overnight. The clay and water was stirred until it was like thick cream; this mixture was poured through a screen wire or sieve to filter out the foreign elements--rocks, twigs, and other non-clay materials; then, the water was allowed to evaporate, leaving the clay. This was not so fine a texture as needed; so the body was placed in a mortar and ground with a pestle. Color variations of this powder were obtained by burning or heating portions of it. To this were added 2 per cent gum-arabic, enough water to make the mixture dough-like, and a

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[12]Mayer, pp. 252-253.

few drops of honey (this prevented the crayon from becoming brittle). This was the pure-color batch, and for variations Ostwald's method of graduating the color was followed. The dough-like mixtures were then shaped into sticks by hand. (See Figure 17.) When the sticks were dry, they were tried out on pastel paper. (See Figure 18.)

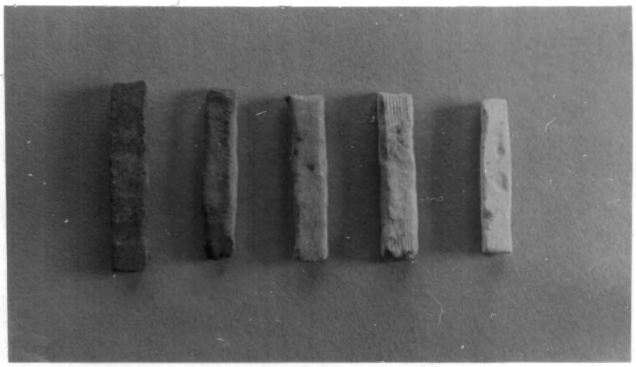

Fig. 17--Pastels made from colored clays.

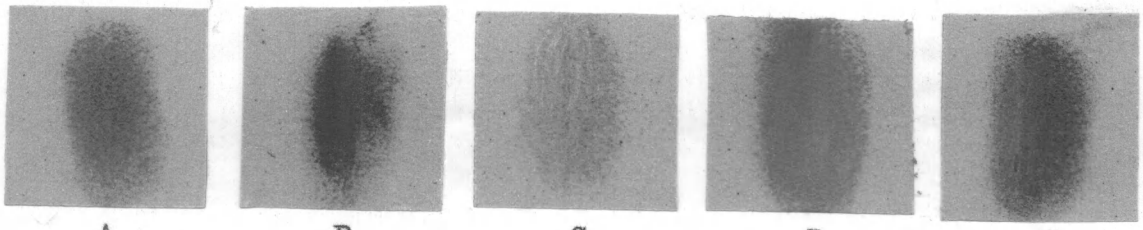

Fig. 18--Marking tests using pastels: (A and B) raw clay pigment, (C and D) tints of A and B, and (E) pigment A burnt before using.

Evaluation of Experiments

Satisfactory pastels were obtained by using the native clays in place of commercial colors. The colors were rich

and clear and they had good adhering quality. The advantage gained was not only economical but also educational.

Finger-paint

History of Finger-paint as a Painting Medium

According to Wolf it was during the T'ang Dynasty that a painting technique known as chih hua was developed by the Chinese. The painting was made by dipping the fingers or fingernails into paste or liquid coloring matter and producing the picture without the aid of a brush.[13]

Runes states that this ancient technique is ideal for the child's procedure of representation and that the technique is adaptable to the child's preference in that he works with his fingers directly. One of the main advantages of this medium derives from its highly valued use in therapeutic work. The paints used by Runes and those used in modern classrooms are opaque water colors to which starch is added as a binder. These colors can be superimposed easily.[14]

Description of Experiments

Two recipes, to which tempera of desired color may be added, were used to perform the following experiment in making finger-paint:

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[13]Martin Wolf, Dictionary of Arts (New York, 1951).

[14]D. D. Runes, Encyclopaedia of the Arts (New York, 1946).

Starch method.--The following recipe for making finger-paint uses starch as a base:

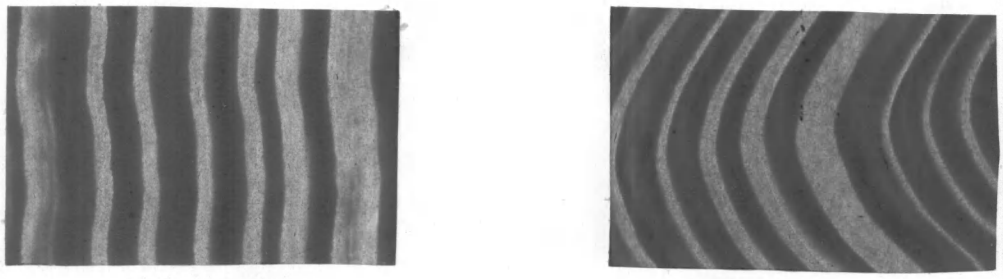
1 part dry tempera
3 parts thick starch
1 part soap flakes
A few drops of oil of cloves

Flour-paste method.--The second recipe for making finger-paint uses paste as a base:

1 cup flour
1 cup sugar
1 tablespoon powdered alum
1 quart water

Mix well and cook until transparent. Add 30 drops of oil of cloves to prevent spoilage. Add desired color of tempera.[15]

Tests were performed using the finger-paint on paper: first, making the application with the hands; and second, with a bristle brush. The brush-applied surface was gone over with a piece of toothed cardboard, which produced a design suitable for a book paper. (See Figure 19.)



A B

Fig. 19--Samples of combed finger-paint on paper to be used for book binding. (A) Design using starch method. (B) Design using paste method.

[15]These recipes were supplied by the Department of Art of North Texas State College.

Evaluation of Experiments

The finger-paint made from both recipes produced an excellent and workable medium worthy of being introduced into the school art program.

The only advantage of the starch over the paste method was that it did not attract bugs.

CHAPTER IV

BRUSHES AND PENS

Brushes

History of Brushes as a Tool

The chief tool of the painter, the brush, has not changed appreciably in the entire history of art. Since Greek times brushes have been made of animal hair tied into a tuft and set in or tied on a stick or a quill. In the prehistoric period brushes made of feathers were used by African Bushmen for painting their caves;[1] the ancient Egyptians used reeds, which were soaked in water and the tips crushed into flexible fibers,[2] but with the exception of the use of hair by the Greeks, there has been very little improvement since 3000-2000 B.C.[3]

Modern Uses of Brushes as Tools in Art

Today, brushes are made in every size and shape to fit the needs of everyone. For the art student and the artist there are brushes with long hair for water-color painting; stubby hair for short crisp strokes in oil painting; soft hair for softening harsh lines in paintings; round and flat

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[1] Encyclopaedia Britannica, IV, 692.

[2] Wolf, p. 1.

[3] Wolf, p. 3.

tufts for fresco painting and lettering; stiff hair for stenciling; and special sizes of hair for one-stroke or fine-line design work. There are brushes for gluing, pasting, ink washing, ink drawing and sketching, ceramic designing and glazing, and enameling on metal.

Description of Experiments

Cennini's method.--A method of making brushes, then in use by artists, was recorded by the monk, Cennio Cennini, in 1437:

> . . . take the straightest and firmest hairs; and gradually make up little bunches of them; and wet them in a goblet of clear water, and press them and squeeze them out, bunch by bunch with your fingers. Then trim them with a little pair of scissors; and when you have made up quite a number of bunches, put enough of them to gether to make up the size you want your brushes. When you have made these types, putting them together very evenly, with each tip on a line with the other, take thread or waxed silk, and tie them up well with two bights or knots, each type by itself, according to the size you want the brushes. Then take a feather quill which corresponds to the amount of hairs tied up, and have the quill open or cut off, at the end; and put these tied-up hairs into this tube or quill. Continue to do this, so that some of the tips stick out, as long as you can press them in from outside, so that the brush will come out fairly stiff; for the stiffer and shorter it is the better and more delicate it will be. Then take a little stick of maple or chestnut or another good wood; and make it smooth and neat, tapered like a spindle, and large enough to fit tightly in this tube; and have it nine inches long. And there you have an account of how a minever brush ought to be made.[4]

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[4]Cennini, p. 40.

Modified method.--By following Cennini's method of making brushes, satisfactory results were obtained; however, it was decided to use bamboo cane in place of the quills and to substitute wax for the cement or binder to see whether an excellent brush could thus be made.

The needed materials were: mink or squirrel hair, tips of bamboo cane, wax, and thread. Also needed were a bowl with water and a pocket knife or Exacto knife.

The hair was prepared by making bunches of it, wetting them in water, then taking a waxed thread and tying them up at the base end. Melted wax was used to work the bases of the tufts together, adding tuft after tuft until the desired size of brush was obtained, and waxing and tying the bases together. An Exacto knife was used to hollow or clean the bamboo cane, for the placement of the tuft of hairs. Some wax was placed inside the hollow cane; the tuft was placed inside the hollow space, making sure that the fitting was snug and tight; then the wax was heated inside the bamboo cane and allowed to run into the waxed base of hair. This aided in setting and holding the tuft in place. (See Figure 20.)

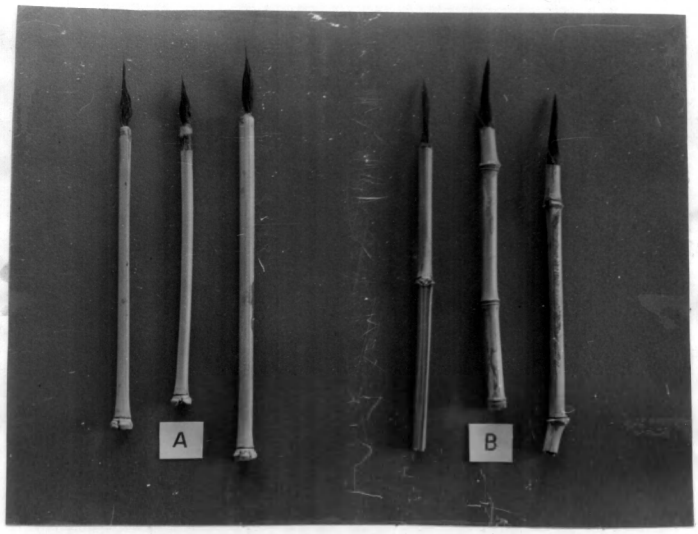


Fig. 20--Brushes made of (A) mink and (B) squirrel hair.

Tests using both mink and squirrel brushes were performed to evaluate their flexibility and line quality. Showcard color, water color, and casein were used for these tests. (See Figures 21 and 22.) A test using ink was also performed. (See Figures 15 and 16, page 28.)

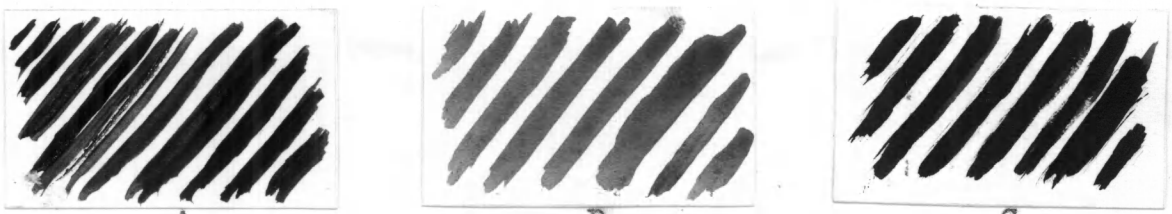


Fig. 21--Mink brush strokes using (A) showcard color, (B) transparent water color, and (C) casein.

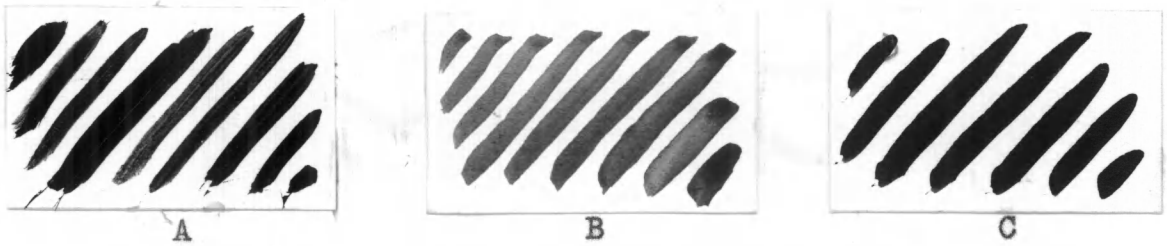


Fig. 22--Squirrel brush strokes using (A) showcard color, (B) transparent water color, and (C) casein.

Pioneer method.--Knowledge of the masticated reeds used by the ancient Egyptians, and the masticated twigs used by the early settlers of our country when dipping snuff, prompted the following experiment: using twigs with macerated tufts for paint brushes.

The needed materials were: twigs of privet hedge, salt cedar, and peach tree. Also needed were a container of water and a hammer.

The twigs were cut to the desired size--remembering that the tuft and holder are one. The tips, soaked overnight in water, were crushed with a hammer and were dipped occasionally in the water during the crushing process. A satisfactory flexible tuft was obtained by testing the tuft at intervals during the process, stopping the crushing process at the flexibility desired. (See Figure 23.)

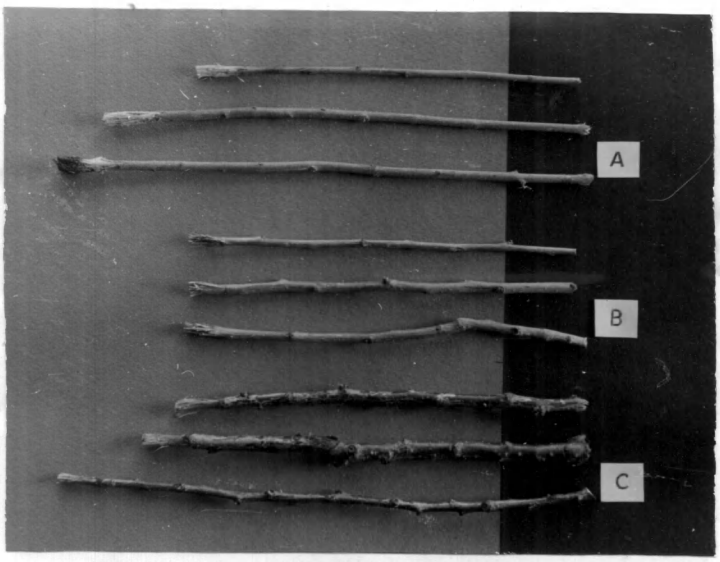
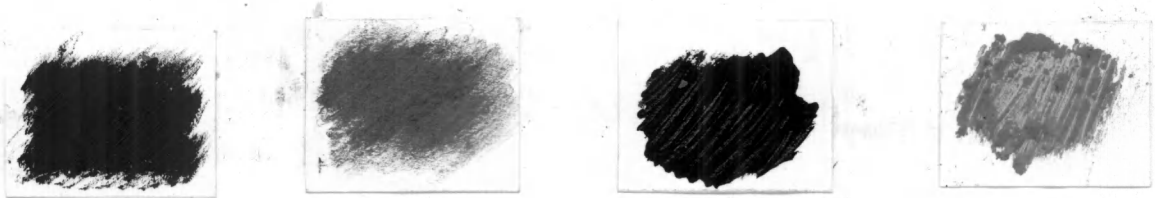


Fig. 23--Brushes made from twigs: (A) privet, (B) salt cedar, and (C) peach.

Performance tests were run using the twig brushes for painting with oil, water color, showcard color, and casein. Tests using paste, glue, and encaustic wax were performed with these brushes for further possibilities of a good "throw-away" brush. (See Figures 24, 25, and 26.)

A B C D

Fig. 24--Strokes made by privet twig brush using (A) showcard color, (B) water color, (C) casein, and (D) encaustic wax.



A B C D

Fig. 25--Strokes made by salt cedar twig brush using (A) showcard color, (B) water color, (C) casein, and (D) encaustic wax.

A B C D

Fig. 26--Strokes made by peach twig brush using (A) showcard color, (B) water color, (C) casein, and (D) encaustic wax.

Evaluation of Experiments

Desirable results were obtained by using mink, squirrel, and macerated ends of twigs as tufts in the

manufacture of brushes. The process using hair for tufts required more time and skill, while that of producing the twig tufts was quick and easy.

The squirrel and the mink brushes were both very flexible and soft, making them suitable for use by art students.

The twig brushes would be ideal for use in the classroom since they are easily made and can be discarded after one use. Of the tests run on the twig tufts, it was found that they were very suitable for use in pasting, gluing, and encaustic work, and the throw-away feature would add to their value when cleaning is a problem. Of the twigs used, the salt cedar was more flexible and easier to use than those of the peach and privet hedge. The cedar appeared to have a better and more defined pulp pattern than the other two tested.

Pens

History of Pens as an Art Tool

The writing implements of the Egyptians were reeds about ten inches long. The diameter varied. There were two types of implements: one was split--the prototype of the quill or steel-pointed pen, and the other was merely bruised or fluffed for a feathery effect--the prototype

of the hair-tipped brush. Hollow bamboo stalks were similarly used in the Orient.[5]

A writing implement used by the Romans was the stylus, a pointed bodkin of metal, bone, or ivory used for producing incised or engraved letters on boxwood tablets covered with wax. Although metallic pens date back to Pompeii, they did not come into full use until the late nineteenth century. The machine process of manufacturing metal pens finally displaced the older handmade pens.[6]

Modern Uses of Pens as an Art Tool

Today, pens are being made with a large variety of points for the art student and the artist. Pen points used in lettering and advertising art are manufactured with nibs that are round, flat, or slanted, wide or narrow, while others follow the usual pointed type. There are flexible pens, such as the crowquill, whose points are exceedingly fine, the quality of line depending solely upon the pressure exerted on a point. Nevertheless, there is no kind of line made by modern pens that could not be duplicated by the handmade implements of ancient times; and for this reason, the production of handmade pens is at the present time a practical subject for experimentation.

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[5]Wolf, p. 101.

[6]Encyclopaedia Britannica, XXI, 83.

Description of Experiments

Cennini's method of making pens from quills.--Although quill pens were made in ancient times, Cennini, in the sixteenth century, gave the first written directions for their production. His directions for cutting a pen from a quill were:

> If you need to learn how this goose quill should be cut, get a good, firm quill, and take it, upside down, straight across the two fingers of your left hand; and get a very nice sharp penknife, and make a horizontal cut one finger along the quill; and cut it by drawing the knife toward you, taking care that the cut runs even and through the middle of the quill. And then put the knife back on one of the edges of this quill, say on the left side, which faces you, and pare it, and taper it off toward the point. And cut the other side to the same curve, and bring it down to the same point. Then turn the pen around the other side up, and lay it over your left thumb nail; and carefully, bit by bit, pare and cut that little tip. . . .[7]

> After the first horizontal cut, which removes the last half inch or so of the lower half of the quill, a small slit is started with the knife at the middle of the end of the upper half. Holding the tip of the right thumb firmly against the top of the quill half or three quarters of an inch from the end, a small stick is inserted a short way into the quill with the left hand, and given a sharp twitch upward. This action normally causes the slit started with the knife to break back neatly to the point where the pressure of the thumb arrests it.[8]

> . . . cut that little tip and make the shape broad or fine, whichever you want, either for drawing or for writing.[9]

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[7]Cennini, p. 8.

[8]E. Johnston, Writing, Illuminating and Lettering (London, 1920), p. 51.

[9]Cennini, p. 8.

Pens made from quills, cane, and bamboo stalks.--Using Cennini's method for cutting quills, good pens were made not only from quills but also from native cane and bamboo stalks.

The following materials were assembled for the experiments: cane or bamboo cuttings about ¼ inch to ½ inch in diameter and 5 to 6 inches in length, a sharp pocket knife or Exacto knife, and ink and paper for testing the pen points.

In making the reed and bamboo pens, the cuttings were cleaned by removing all buds, nodes, or sprouts. The prepared lengths were made into pens in the following manner: (1) One end of the stalk was cut horizontally ½ inch from the end and half-way around the circumference. (2) Vertical incisions were made so that half of the end could be removed. From the center of the remaining semicircle equal spaces were marked off to indicate the desired width of the nib. (3) The two vertical sides were then cut obliquely from the top to the points marked for the nib. (4) The pen was laid on its back and pared and trimmed until the tip was thin and flexible. (5) A vertical incision 1/8 inch long was cut up through the center of the nib. (See Figure 27.)

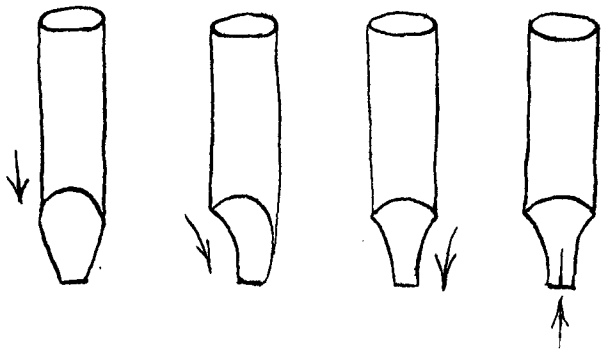

Fig. 27--Steps used in cutting the point of a reed or quill pen.

With paper and ink, the pens were tested to see if further trimming was needed to produce the desired width and flexibility of the nibs. When the desired results were obtained, the pens were further tested by using them for drawing and writing with various kinds of inks.

Evaluation of Experiments

Satisfactory results were obtained from all of the experiments performed and in drawing and writing tests.

Both turkey and chicken quills were found to be suitable for use in the manufacture of pens. The only noticeable difference in the two was the size of the diameter--the turkey quill being the larger. Finer lines could be made with the quills, but the points were more fragile than those of cane or bamboo. (See Figures 15 and 16, page 28.) The cutting of the quills required more

skill because of the fragility of the material and the small diameters. This made the process tedious; therefore, it is not recommended for the school laboratory.

The cane and bamboo pens made wide and graduated lines possible, and they also held up better under use. Since they absorbed extra ink in the beginning, because of their fibrous nature, they were not effective until they had been used long enough to counteract this characteristic. The availability of materials at little or no cost would make this experiment worth trying with secondary-school art students.

CHAPTER V

CONCLUSION

Certain experiments resulted in products that were very satisfactory as to quality, simplicity of manufacture, and cost.

Of the papers made from cotton and linen rags, the linen rags produced paper with better quality and of greater strength. The process of paper-making was very simple and the cost was negligible. In making tracing papers, linseed oil gave the greatest transparency, while costing no more than the other oils used. Of the pastel papers made, sand and powdered pumice-stone proved equally efficient as an abrasive, while Elmer's Glue-All was the most easily applied and the most economical of the binders used.

The surface treatments used in making painter's canvas were satisfactory in texture and as a painting support. Ducking cost less than the other fabrics. Of the primers tested, casein was the easiest to apply and also the cheapest.

A good grade of charcoal was made, which proved to be not only a desirable drawing tool but a good pigment source

for ink as well. The aluminum foil was the only material that had to be purchased for the charcoal experiment. No difficulties were encountered in producing the charcoal that could not be easily overcome by a group of high-school students.

A good grade of pastels was made from native clays, which produced some unusual earth colors. The production was lengthy, but the quality of the end product proved its validity. The ingredients used cost little or nothing.

Of the finger-paints made, both kinds were practical and the recipes were simple and economical.

Brushes made from twigs were easier to make than those made from hair tufts, and the materials used did not cost anything. Of the twigs used, salt-cedar twigs made the best tuft.

Of the pens made, those of cane and bamboo were stronger and had more durable points than those made from quills.

The success of these experiments indicates that the history of art tools and media is a rewarding study and that many other experiments might be attempted that would enrich the experiences of the artist or the art student.

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