A STUDY OF THE DESIGN POSSIBILITIES AND TECHNIQUES OF POUNDING PLANTS INTO FABRIC AND PAPER

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A STUDY OF THE DESIGN POSSIBILITIES AND TECHNIQUES OF POUNDING PLANTS INTO FABRIC AND PAPER

THESIS

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF ARTS

By

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Denton, Texas
August, 1968

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CHAPTER I

INTRODUCTION

The desire of man to decorate clothing, skin and household objects started perhaps with the discovery that the juice from a crushed berry or leaf rubbed on his skin or a bit of leather would leave a color. The art of dyeing leather, yarn, woven fabric or paper with solutions made from plant parts was well known to ancient man. The techniques came down through recorded history and were widely used and constantly refined until the process of mass-produced chemical dyeing became dominant in this century. Although natural dyeing on a large scale has become impractical, the process is well documented by many books and articles and is practiced by many artist-craftsmen.

One technique of dyeing, the pounding of plant parts directly onto fabric or paper, has long been known and used by the Japanese and the American Indian, and, although currently practiced by at least one interested person, little research has been done to refine the technique into a workable craft medium. Limitations inherent in the solution dyeing technique impose rather severe design restrictions on the artist-craftsman--he may vary his design effects only by changing the color of his dye bath, and/or he may impart pattern to his fabric through use of the tedious resist or tieing methods of dye control. The pounding technique, because it involves a direct transfer of a printed image (in addition to the natural vegetable dye) from plant to fabric and paper, expands the designer's visual language by introducing new textures, lines and forms. Because it was felt that any technique that enriches the artist's available fund of visual effects was worthy of investigation, this little-known method of fabric design was chosen for exploration and development.

The Problem

The problem of investigating the possibilities of direct design transfer from plant to fabric and paper was divided into two parts. The first part is concerned with the exploration of the mechanics of the transfer. Involved in this process are the technique of manipulating tools, of selecting suitable fabrics and paper, of determining chemicals that would facilitate the printing process and of experimenting with ways to preserve the finished design. The evaluation of the usability and durability of the finished print was based on a series of color fastness tests.

The second part of the problem is concerned with the exploration of the design possibilities of the medium. The plants were tested and rated according to their visual attributes relative to the elements of design. Combinations of the successful plant prints were used to produce variations of pattern and texture. The results of the investigation were evaluated to determine the versatility of the medium as a design tool and the usefulness of the technique as a practical printing method.

Limitations of the Problem

The study was limited by the geographical area explored, by the calendar season, by the mechanical process employed and by the fabric and paper used. Some of the limitations developed naturally through early testing and research and are inherent in the medium; other limitations were set to allow a thorough analysis of the design possibilities of the medium as developed in the second part of the problem.

Because of the variety of soil and climatological conditions and the tendency to sunny summer days, Texas has the greatest variety of wildflowers of any state in the United States.[1] The number of species of trees found within the boundaries are second only to Florida, and the abundant varieties of native grasses are a basic natural resource.[2] The vast amount of native vegetation, plus the varieties of easily cultivated plants, necessitated a geographical limitation. The ten

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[1]"Wild Flowers of Texas," unpublished script from a series of slides, Texas Highway Department, Travel and Information Division, Austin, Texas, n. d., p. 2.

[2]Herbert S. Zim and Alexander C. Martin, Trees (New York, 1963), p. 6.

geographical areas used by the Texas Agricultural Extension Service facilitate the documentation of climate, soil and plant life.[3] This study was based on use of plants from the Dallas area, which is located in the vegetational area known as the Blackland Prairie.[4] This area, while providing a

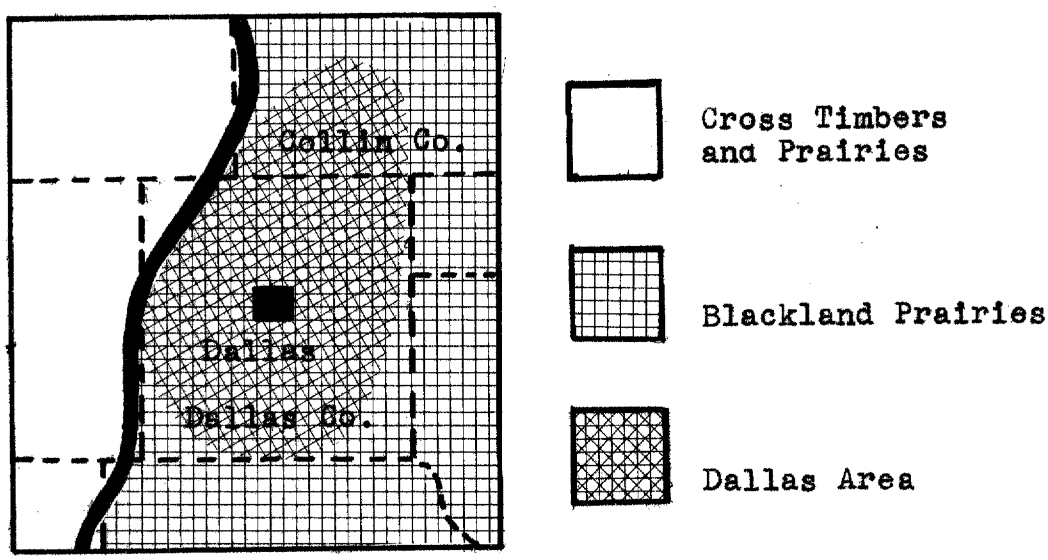

Fig. 1--Vegetational area of consideration

wide variety of species, reduces the total number sufficiently to enable a comprehensive analysis of the print making potential and design qualities of the pounding process.

Although some variety of vegetation is available during any season of the year, mid-growing season leaves that contain a moderate amount of sap have been found to be best for

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[3]G. O. Hoffman and B. J. Ragsdale, Know Your Grasses (College Station, Texas, n. d.), p. 45.

[4]*Ibid.*, p. 44.

printing.[5] This study is based on plants that were available during the late spring and early summer.

Test samples made with fabrics of pure fibers of cotton, linen, silk, and wool proved that the tightly woven small threads of bleached cotton domestic and white wool crepe provided a consistently good background for all types of leaf prints. Both fabrics are readily available and easy to print. The same mordanting process could be used successfully on both fibers.

To reduce the number of processes to a minimal number, the mordanting process was limited to the use of a single agent, potassium aluminum sulfate. Tests proved that this agent, commonly called alum mordant, was easy to make, worked well on both fibers and facilitated printing.

A limitation inherent in the medium became apparent as a series of tests to determine the degree of color fastness of the prints was conducted. Because the usefulness of the completed print depends upon the degree of color fastness, the negative results of the tests discussed in Chapter II produced the greatest limitation of this study.

Various qualities, thicknesses and types of paper tested with some degree of success. Construction paper and art fabric proved absorbent enough to give clear impressions from

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[5]"Old Indian Craft Enhances Modern Decor," National 4-H News, XLVI (June, 1967), 17. (This article, based on the material gathered by Friends magazine, details more of the mechanical process.)

the largest variety of leaves. Chemical mordants were impossible to use on the paper. Only white paper and cloth were considered suitable grounds for use in this study so that accurate design evaluation could be made.

Procedure

Initial interest for this study began with the reading of an article in Friends magazine written about a woman who had revived an old Cherokee skill of printing from plant parts directly onto fabric.[6] Subsequent research about the technique produced much information about natural dyeing but only one short reference to this method of direct printing from plant parts. This reference concerned the use of the technique by the Japanese.[7] The procedure as presented in this study was developed by combining some aspects of the well documented processes of natural dyeing with the technique described in the article in Friends magazine. It is hoped that the procedure presented will prove to be simple enough to be practical, successful enough to be interesting and yet will not confine the creative abilities of the craftsman.

Before the actual pounding of the plant parts could be done, the fabric ground had to be washed and mordanted. Neutral soap was used to make two separate lukewarm suds baths

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[6]"Hammered Prints in Leafy Pattern," Friends, XXI (August, 1965), 29.

[7]Charles E. Pellew Exmouth, Seventh Viscount, Dyes and Dyeing (New York, 1918), p. 31.

to remove the commercial sizing. Four or five lukewarm rinsings were necessary to assure the removal of all the soap residue. Care was taken in testing the water temperature before immersing the fabric, because sudden changes in temperature cause wool to mat or felt.[8] Cotton fabric could withstand any temperature, even boiling. A nominal amount of shrinkage was experienced from both fabrics and was allowed for in the initial measurement.

Many sources give directions for making and using an alum mordant. There is very little variation in the different methods. The mordanting method employed was based on the use of a pound of dry wool fabric, but the quantity was frequently proportionally reduced to one-fourth so that a small amount of wool or cotton fabric could be used. The same mordanting procedure was used with both fabrics. Chapter II which contains descriptions of the mechanical procedures employed gives detailed information for preparing mordants.

The types of leaves used for the pounding process varied greatly and will be discussed thoroughly in Chapter III. A sufficient amount of moisture to transfer the colors and patterns of the leaves to the paper or fabric was the one common necessary element for successful printing. A print was

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[8]Elizabeth Lane Coulter, "Some Dye Plants of the Texas Plains Region and Analyses and Verifications of Their Dye-Producing Qualities," unpublished master's thesis, Department of Art, North Texas State University, Denton, Texas, 1941, p. 29.

accomplished by padding a very smooth surface with several thicknesses of newspaper, covering the pad with a sheet of waxed paper and placing the cloth or paper to be imprinted on top of it. The leaf was then positioned and covered with another sheet of waxed paper. While carefully holding the leaf in place, a metal claw hammer was rather forcefully but evenly employed to make the impression. Progress of the print could be checked by carefully raising the edge of the waxed paper and a small area of the leaf. If necessary the leaf could be tapped again with the hammer.[9] The finished print was allowed to dry several hours before being sprayed with a commercial fixative.

Design Analysis

Knowledge of the precise procedure used to produce successful prints is of little value unless the design potential of the medium is thoroughly understood and successfully employed. In Chapter III the elements--line, form, texture, and color--are represented in a group of sample plant prints which are displayed in a series of forty-eight plates, arranged alphabetically according to plant name. Each plate treats of one plant variety and includes, besides prints made on four different grounds, a contour line drawing illustrating the plant and two charts which rate the prints as to technical and visual qualities.

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[9] "Old Indian Craft Enhances Modern Decor," p. 16.

There is in every example of good design the presence of some, if not all, of the fundamental art elements and principles which have not changed since the first beautiful painting was made on the wall of a cave thousands of years before the birth of Christ.[10] The elements of line, shape, space, texture and color are the building blocks used to construct a pleasing composition. Balance, continuity and emphasis are the design principles which relate to the arrangement of the design elements in a composition.[11]

The plant charts in Chapter III are arranged alphabetically by the botanical name of the plant. The common name is included on the chart. Each chart contains a line drawing to illustrate the plant, a sample print made on each of the four grounds and an analysis of each print as to its design potential. The charts serve a threefold purpose: first, the plants available in the Dallas area are surveyed; second, the print produced from each plant on each type of fabric and paper is rated as to whether it is of excellent, good, fair or poor quality; third, each print is evaluated as to its usefulness as a design element.

Analysis of the charts explores the design possibilities of the medium by suggesting possible compositional handling

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[10]N. I. Cannon, Pattern and Design (London, 1948), p. 9.

[11]Ray Faulkner, Edwin Ziegfeld and Gerald Hill, Art Today (New York, 1962), p. 357.

of the elements. Page size compositions are used to illustrate the design potential of this printing procedure.

Definitions of Terms

The terms and supplies used in this study are, in many cases, widely known and commonly used. The alphabetized list of definitions and descriptions of the way the terms apply to this study is offered to expedite the reading and to eliminate any misunderstanding resulting from regional or brand differences.

Alum: The white powder, potassium aluminum sulfate, commonly known as potassium (or potash) alum. The alum found in grocery stores is ammonium alum; this is less successful as a mordanting agent.[12]

Art fabric paper: A non-woven fabric made of natural and synthetic fibers bonded chemothermically.[13] The inherent qualities of this paper closely parallel those of the non-woven fabric trademarked by the name of Pellon.

Bleached cotton domestic: The cotton fabric used for household goods such as sheets, pillowcases, towels and other household articles.[14]

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[12] Dye Plants and Dyeing--A Handbook (Brooklyn, New York, 1968), p. 9.

[13] Stephen S. Marks, editor, Fairchild's Dictionary of Textiles (New York, 1959), p. 407.

[14] Ibid., p. 185.

Construction paper: A paper that is made from mechanical pulp similar to poster paper, manufactured in a wide range of colors and used commonly by kindergartens and grade schools for cutouts and cheap mounts.[15]

Cream of tartar: The white powder, acid potassium tartrate. It is commonly found on grocery store shelves.[16]

Ground: A surface used for a particular purpose.[17] It applies in this study to the construction paper, art fabric paper, wool crepe and bleached cotton domestic used for the background of the plant prints.

Mordant: The substance that when applied to fabric comgines chemically with the coloring matter and sets the color.[18]

Neutral soap: A natural cleaning agent made from fats and oils either by saponification with alkali in the boiling or the cold process, or from fatty acids by neutralization with alkali.[19]

Soft water: Water, such as rain or distilled water, that is free from significant amounts of calcium and magnesium salts.[20]

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[15]The Dictionary of Paper (New York, 1965), p. 134.

[16]Dye Plants and Dyeing, p. 10.

[17]Noah Webster, Webster's Seventh New Collegiate Dictionary (Springfield, Massachusetts, 1965).

[18]Dye Plants and Dyeing, p. 10.

[19]Noah Webster, Webster's Third New International Dictionary of the English Language (Springfield, Massachusetts, 1963).

[20]McGraw-Hill Encyclopedia of Science and Technology (New York, 1966), p. 408.

Spray fixative: A permanent protective coating commonly used to protect, waterproof and help prevent color fading of compositions done in media such as chalk, charcoal, and crayon. The brand used in this study is Krylon.

Wool crepe: A fabric of pure wool fibers woven by a plain weave in various weights and crepe effects.[21]

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[21] Marks, op. cit., p. 611.

CHAPTER II

TECHNICAL TESTS AND PROCEDURES

Source materials supplied only limited information as to the process of setting color and the kinds of materials suitable for use as grounds in the technique of making hammered prints. Research into the field of natural dyes led to the belief that paper, fabrics other than cotton, mordants commonly used in solution dyeing and other methods of setting color could be combined with the original process to give a greater variety of effects. If additional ways might be found to set the print color the designer would be given a choice of methods, and, hopefully, greater permanency of color in the prints might result. To verify these suppositions a series of tests were made. The first part of this chapter discusses these tests. Analysis of the tests resulted in the addition of a variety of ground materials, a method for mordanting fabric and the substitution of a commercial spray fixative for the lye water method described in the source article.[1] The second part of the chapter describes the step-by-step method used to make the examples of the plant prints seen in Chapter III.

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[1]"Hammered Prints in Leafy Pattern," Friends, XXI (August, 1965), 28-29.

Preliminary Tests to Determine Procedure

Tests were conducted using fabrics of unblended natural fibers--cotton, linen, wool and silk. Man-made fibers or blends were not considered practical to use in this test because the great variance in their chemical nature would necessitate many time-consuming tests to determine heat and chemical reaction. However, it is not to be assumed that some of these would not work well with proper testing. Wool crepe, bleached cotton domestic, a plain weave linen and silk linen in white or near-white were chosen for testing because each was available locally, contained pure fibers and was tightly woven with small threads. None had an outstanding weave or nub that would tend to obscure the print of the plant.

Before starting the mordanting and printing process, the natural grease of the wool, the waxy finish on the silk and the commercial sizing that may be present in any fabric had to be removed by washing. Two separate washings in suds made by mixing two tablespoons of mild white soap (not detergent) in a gallon of warm water, followed by four thorough rinsings, readied the fabric for use.[2]

Experimental plant prints were made on a number of untreated fabrics of varied fiber content. Fabrics woven of cotton and wool yarns proved to be the most satisfactory,

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[2]Dye Plants and Dyeing--A Handbook, (Brooklyn, New York, 1968), p. 10.

clearer and more interesting forms and textures were produced on these fabrics due to their ready absorption of the plants' coloring pigments. Although these washed fabric samples absorbed plant dyes to a degree, they were not considered successful enough to recommend their use as a ground for the medium unless treated with some sort of mordant which would facilitate the dyeing or printing process.

The next tests were carried out with mordants. Mordants are chemical baths that help to set or fix the dye in the fiber of the fabric.[3] In solution dyeing, mordants may be used before dyeing, during the dye process or after the dyeing is completed.[4] Because the printing process used in this study is carried out on dry fabric, only the before-dye mordants were considered.

Because there are many small variations in the directions for making mordants, one reputable source was cited for each test in this study. One mordant, the alum-tannic acid-alum method, was chosen to test cotton and linen.[5] This mordant, with slight variations in formulation, was the only one found for cotton and linen in any source. The before-dye mordants, commonly known as chrome, vinegar, tin, alum and copper, were

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[3]Elizabeth Lane Coulter, "Some Dye Plants of the Texas Plains Region and Analyses and Verifications of Their Dye-Producing Qualities," unpublished master's thesis, Department of Art, North Texas State University, Denton, Texas, 1941, p. 30.

[4]*Ibid.*, p. 30.

[5]*Dye Plants and Dyeing*, p. 12.

chosen for testing with wool and silk. This group of mordants, with slight variations in measurements and procedures, is the basis for discussion of the mordanting process found in the major sources on natural dyeing.

Formulation of each mordant will be detailed later in the chapter, but general directions and basic tools and supplies can be noted here. Wool is the most frequently used fiber in solution dyeing, but care must be exercised to avoid damaging the fabric. It should never be twisted when removing liquid, because the wrinkles will be all but impossible to remove.[6] To avoid matting or felting of the fabric, it is important not to let the wool boil, but simmer, not to change the temperature suddenly, and to keep the yarn or cloth completely submerged during the whole process.[7] The same mordants may be used on both silk and wool, but the temperature for silk should not exceed 160 degrees Fahrenheit.[8] Any fabric should be thoroughly wet before it is entered into the mordant bath.

The same equipment is needed for all mordanting methods: a container, stirring rod, measuring spoons, cup, an accurate cooking thermometer and scales for weighing. This equipment should not be affected by chemicals. A good supply of clean soft water is an absolute necessity--rain water is the best.[9]

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[6]*Ibid.*, p. 10. [7]*Ibid.*, p. 10.

[8]*Ibid.*, p. 13.

[9]Ethel M. Mairet, *Vegetable Dyes* (London, 1938), p. 2.

In formulating each mordant, quantities are determined in common practice by the amount required to treat one pound of dry fabric. For this series of tests each amount was reduced to one-eighth without adversely affecting the success of the process.

The following specific directions for making and using each mordant are quoted from various sources. The analysis of the usefulness of each to this study determined the one used.

> The Alum-Tannic Acid-Alum Mordant (for cotton and linen)
>
> For each pound of dry material use:
> 8 ounces alum (potassium alum)
> 2 ounces washing soda (sodium carbonate)
> 1 ounce tannic acid
>
> Dissolve half the alum and half the soda in 4 to 4½ gallons of cold soft water. Wet the material in clear water, immerse it in the bath and heat gradually. Boil one hour. Then let it slowly cool and remain overnight in the bath.
>
> Next day, squeeze the moisture from the cloth, rinse it well, then put it in a prepared bath of 4 to 4½ gallons of water with the ounce of tannic acid. Heat and hold it at this temperature for one hour, meanwhile working the material through the bath. Cool, and let it stand overnight. Rinse lightly. Prepare a third bath of 4 to 4½ gallons of water with the remaining 4 ounces of alum and 1 ounce of soda. Repeat the first process, boiling one hour and leaving overnight. Next day, squeeze the material partly dry; rinse it before dyeing.[10]

This method proved unusable because the fabric color was changed from white to dull, pale tan. One of the limitations of the problem stipulated the use of a white background

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[10]*Ibid.*, p. 12.

so that accurate color evaluations of the plant prints could be made.

> Copper Mordant (for wool)
>
> 3% copper sulphate crystals (bluestone)
> 2% oxalic acid or 3% cream of tartar
>
> The percentage figures in the above rules are based on the weight of the wool. The usual mordant-bath or dye-bath has about forty times the weight of the wool. . . . .
>
> Dissolve the mordant thoroughly in sufficient water to cover the wool completely, which will usually take about five or six gallons of water to one pound of wool; put the pot of dissolved mordant on the fire, and when the liquid begins to get warm, enter the wool which has been washed thoroughly and well rinsed; bring the temperature up gradually until it reaches the boiling temperature, or boiling gently. Keep at this temperature, turning the cloth over occasionally so that the mordanting will be done evenly, for three-quarters of an hour (and sometimes it may be kept at a simmer for as long as two hours, by some dyers). At the end of this simmering, lift the wool out, using two smooth, clean sticks, and hold it out of the solution until the excess liquid has dripped out of it; then lay the wool in an agate collander [sic], and gently squeeze out as much more of the liquid as possible; then the wool may be rolled in turkish towelling and kept in a cool place until the dye-bath is prepared.[11]

Because the process of printmaking used in this study calls for dry fabric, the mordant was allowed to dry in the fabric, then rinsed well and dried again before pounding. If a colander is not available, the fabric can be drained by suspending it in a square of clean absorbent fabric.

The very attractive pale blue-green of the fabric eliminated this mordant from consideration in this study. It is

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[11]Sallie Pease Kierstead, Natural Dyes (Boston, 1950), pp. 24-26.

a very compatible color to use with the natural pigments of plants, and the chemicals facilitate the printing process. It is worthy of consideration for use in achieving special effects.

Chrome Mordant (for wool)

1 pound dry wool
3½ teaspoonfuls potassium dichromate
4 gallons lukewarm soft water

Dissolve the potassium dichromate in the water. Put in the wool cloth or yarn which has been wet thoroughly. Raise the temperature gradually to a boil and boil one hour. Stir or turn material carefully several times. As the water boils away, add more boiling water so that the amount of liquid remains the same. Cool gradually and allow the material to stay in the mordant overnight. On the following morning dry the material without rinsing and put it away until it is needed for dyeing. Before the wool is immersed in the dye-bath, the mordant should be washed out.[12]

The mordant was allowed to dry in the fabric before it was rinsed and again dried. The mordant turned the fabric a rather dark brown-gold that could not be considered for use in this study.

Vinegar Mordant (for wool)

1 pound dry wool
1 gallon vinegar
3 gallons lukewarm soft water

Immerse the wool, which has been wet thoroughly, in the water and vinegar solution. Raise the temperature gradually to a boil. Boil slowly one hour. Stir or turn the wool carefully. As the water boils away, add more boiling water, so that the amount of liquid remains the same. Cool gradually and allow the material to stay in the solution overnight. On the following

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[12]Coulter, op. cit., p. 31.

> morning dry without rinsing. Put away until the wool is needed for dyeing. Before it is immersed in a dye-bath, wash the wool well to remove the mordant.[13]

The mordant was allowed to dry in the fabric before rinsing and again drying. This mordant met every requirement for this study. It did not change the color of the fabric, and it facilitated the printing process.

Tin Mordant (for wool)

> 1 pound dry wool
> 2-3/4 teaspoonfuls stannous chloride
> 6 tablespoonfuls cream of tartar
> 4 gallons lukewarm soft water
>
> Dissolve the stannous chloride and the cream of tartar in the water. Put in the wool cloth or yarn which has been wet thoroughly. Raise the temperature gradually to a boil and boil slowly one hour. Stir the wool gently; too much or too rapid stirring will mat the wool. As the water boils away, add more boiling water, so that the amount of liquid remains the same. Cool gradually and allow the material to stay in the mordant solution overnight. On the following morning dry the material without rinsing and put it away until it is needed for dyeing. Before the wool is immersed in a dye-bath the mordant should be washed out.[14]

This mordant met the requirements of this study but was eliminated because of the very offensive odor given off both during the mordanting and drying process. It would be useful if the craftsman had outdoor facilities in which to work.

Alum Mordant (for wool)

> The most commonly used of all mordants is alum (potassium aluminum sulphate, which is the ordinary

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[13] *Ibid.*, p. 32. [14] *Ibid.*, p. 32.

potash of commerce). To mordant wool with alum, usually from one-quarter to one-sixth as much alum to the weight of wool, and from one-twelfth to one-sixteenth of the wool's weight of cream of tartar are used.

FORMULA NUMBER 1

3 ozs. to 4 ozs. alum (according to color desired)
1 oz. cream of tartar
1 lb. wool
Enough water to cover the wool completely

Method: Dissolve the cream of tartar and alum in the water, gradually raise the heat and stir until thoroughly dissolved. Thorough mixing is very important, or the mordanting will be spotty. Unevenly mordanted fabric cannot be dyed evenly. Wet the wool all over in warm water, and gently squeeze out the excess water. As the mordant begins to get warm, enter the wool and raise the liquid to the boiling point, then let it simmer for one-and-one-half to two hours, turning the wool gently every little while. Lift the wool out of the kettle with a smooth stick and let it drain through an agate colander. When it is cool enough to handle, squeeze out the excess liquid, but do not wash the goods. The wool will not benefit by being left in the liquid until the next day, but it may be left draining, hung up in a burlap or cloth bag in a warm place so that it will dry slowly. Slow drying allows the alum to penetrate more thoroughly into the wool. It may be dyed immediately but is better if left for a day or two. Before the mordanted wool is dyed it should be carefully rinsed. In fact, some dyers keep the rinse water at a boiling temperature for at least an hour.[15]

The fabric was allowed to remain in the mordant until cool, then it was rinsed and dried before pounding. This mordant met the requirements of this study in every way.

The three most successful mordants, vinegar, alum and copper, were used with the two previously chosen fabrics, cotton and wool, in a test series. The purpose of these tests was: first, to determine the one mordant to be used throughout the study; second, to test the value of several

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[15]Kierstead, op. cit., pp. 21-22.

rinses as color setting methods; and third, to test the durability of the color of the prints when exposed to light, when drycleaned and when washed in mild soap. Because the only method found for mordanting cotton did not meet the requirements of this study, the formula for mordanting wool was used with both the cotton and wool fabrics.

One plant, common clover, was used to make each print. The printing process used by Dela Owl and described in Friends magazine was employed.

> She lays a sheet of waxed paper on a firm, flat surface and places the cloth to be imprinted on top of it. She positions a leaf on the cloth, places another sheet of waxed paper on top of the leaf, and then pounds the leaf carefully with a hammer. The leaf must be hammered evenly, with sufficient force to make the impression, but not enough to crush it out of shape.[16]

Rinses made from solutions of salt, white vinegar, borax and lye soap were tested because research about solution dyeing had raised the question of their possible value as color setting agents. The lye soap was made by using the formula on the can of a commercial lye. The salt, white vinegar and borax were the types commonly found at the grocery store. Four sample prints were made on each fabric, both mordanted and unmordanted. One was immersed in the salt solution, one in white vinegar solution, one in borax solution and one a lye-soap solution. Each was allowed to soak five minutes before being rinsed in clear water and dried.

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[16]"Hammered Prints in Leafy Pattern," p. 28.

The following procedural variations were tried, using four sample prints of common clover made on each of the fabrics, cotton and linen, with each of the three mordants, alum, vinegar and copper:

1. The plant print was made before the fabric was mordanted.

2. The fabric was mordanted, dried, printed then rinsed.

3. The fabric was mordanted, dried, rinsed, dried and printed.

4. The fabric was mordanted, dried, rinsed, dried, printed then rinsed in a white vinegar solution.

5. The fabric was mordanted, dried, rinsed, dried, printed then rinsed in a salt solution.

6. The fabric was mordanted, dried, rinsed, dried, printed then rinsed in a borax solution.

7. The fabric was mordanted, dried, rinsed, dried, printed then rinsed in a lye soap solution.

8. The clover leaf was dipped in the cool mordant and pounded onto mordanted fabric.

9. The clover leaf was dipped in the cool mordant and pounded onto unmordanted fabric.

To test the durability of the color, one sample of each of the nine tests was kept covered to use as the control. One sample was exposed to direct light for one week. One sample was drycleaned and one sample was washed in a mild white soap solution.

Each mordant, although formulated for use with wool, seemed to facilitate the printing of the cotton fabric. Although the pale blue-green color imparted to the wool by the copper mordant eliminated it from consideration for use in this study, it was included in this series of tests to add another facet to the general procedure. The green pigment of the plant combined with the blue-green color of the wool ground to produce very interesting effects. The color of the cotton fabric was not changed by the mordant. Method 3, the mordant-rinse-print procedure, produced the clearest prints on both fabrics. Method 8, the leaf dipped in mordant and pounded on mordanted fabric, was equally successful, but so little difference was noted that the extra step was deemed unnecessary. The results of the color fastness tests were negative. Exposure to light produced the greatest color loss, but the clarity of the print was also impaired by both dry-cleaning and washing.

The alum and vinegar mordants were equally effective in facilitating the printing process, and both met each requirement of the study. The 3 and 8 methods of printing proved to be the most successful when used with each mordant on each fabric. Neither mordant added a degree of color fastness to the finished print when used alone or when rinsed in any of the solutions. It was noted that wetting the completed print with any solution greatly reduced its clarity, and all samples exposed to direct light lost a great deal of color. Although all aspects of the vinegar and alum mordants proved the same, the alum mordant was selected because alum was the one common ingredient used in the formulas for both cotton and wool mordants.

Further testing of the alum mordant procedure resulted in the elimination of the step which involved drying of the fabric after mordanting and before rinsing--no difference in the ability of the fabric to absorb the color pigment of the plant was noted with the extra step. The final procedure of washing the fabric, rinsing, mordanting, cooling, rinsing and drying was definitely established and used in making all the sample prints and compositions included in Chapter III.

In addition to the pounding technique, another method of applying pressure to the plant part after it was placed on a ground was tested. The same procedure of stacking the pad of paper, wax paper, ground, plant part and cover of wax paper was employed. The stack was placed between two boards and was inserted in an air vise where it was allowed to remain three minutes under 1,780 pounds pressure per square inch. No print resulted on any of the four ground materials although plants were used which had made successful imprints when the pounding method was used.

Leaves from plants that had previously proved to be unsuccessful printmakers and leaves that had printed very successfully were used in a test to determine if the quality of the print could be improved by soaking the leaf in ether for a short time before printing. Dr. A. W. Rosch, botanist in the Science Department of North Texas State University, suggested the possible usefulness of this test because of the common scientific practice of extracting various substances from leaves by extended boiling in ether. The scientific process allows the various substances to be separated and analyzed individually. By allowing the leaf to remain in the ether for a short period of time, it was theorized that the process of extraction would be just started and the pigment could be imparted to the ground more completely.

Ether, an extremely volatile substance, should be used with caution in a well ventilated place. This test was conducted out-of-doors away from any source of spark or flame. The ether was poured into a small enameled pan, and one leaf was immersed in the cold liquid for a short time before printing by the method described earlier in the chapter. The liquid was heated over an electric hot plate while a second leaf of the same type was soaked. No difference was noted between prints soaked in the cold or in the heated solution.

Sample prints of leaves that had previously proved to be successful printmakers and some that had previously proved to be unsuccessful were made by the cold ether method on all four grounds and compared with prints made from untreated leaves. Results of the comparison show that the quality of the prints made from successful, untreated leaves was not improved, except for a slight intensification of the green pigment, while a good sample print was obtained on all four grounds from an American elm leaf, which was one of the leaves that had previously proved to be an unsuccessful print source. Although the test showed positive results, the method was not practiced for use in this study because, first, the dangerous nature of the ether made it practical for use in only the most controlled circumstances and, second, the expense of this liquid that evaporates very rapidly, in the quantity needed to test each unsuccessful type of leaf, would be great. However, an interested craftsman should keep the positive results of this test in mind if a particularly desirable type of leaf does not produce a successful print using other means.

The article in National 4-H News describes the use of a lye solution made from hickory ashes and water to set the color of the plant pigment into the fabric. Lye made from oak or chestnut ashes was deemed usable, but commercial lye was not recommended. Experimentation was advised to find the right proportion of the solution to be used with the fabric.[17] Directions for making and using the lye solution are very simple:

> . . . start by putting one pint of wood ashes into one gallon of water. Let the mixture stand 24 hours, strain the mixture and dilute with another gallon of water. Soak the material to be fixed in the diluted solution for about 15 minutes. Rinse in plenty of clear water and hang up to dry.[18]

The fabric should be ironed before it completely dries.[19]

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[17]"Old Indian Craft Enhances Modern Decor," National 4-H News, XLVI (June, 1967), 16.

[18]Ibid., p. 16.

[19]Ibid., p. 16.

A series of prints made from common clover leaves on mordanted cotton and wool were immersed in the diluted lye solution and allowed to soak fifteen minutes. Sharpness of detail was lost upon contact with the liquid, but the original color remained. One sample of each fabric was kept covered for use as a control; one sample was exposed to direct light; one was displayed in a darkened room; and one was washed four times in a mild soap solution. Definite color loss was noted when the samples were compared with the covered control sample.

The next series of samples was made and tested in the same way except the lye solution was used full strength. In addition to the clover prints, samples made by pounding a variety of leaves and flower parts were tested. Upon immersion into the solution the green pigments lost some detail and the flower petal prints turned a nondescript brown. The full strength solution neither harmed the fabrics nor improved color fastness. Identical fabric samples were dyed with a commercial dye and tested for color fastness along with the print samples. Although a small degree of lightening was noted when the commercially dyed samples were exposed to direct light or washed, it was minimal compared to the color loss of the plant prints.

Tests to determine the effectiveness of paper for use as a ground with this printing process were less involved but no less conclusive. Only white was considered as a background in order to evaluate the color of the plant prints. Construction paper, art fabric, newsprint, tracing paper, block printing paper and rice paper were chosen for preliminary tests. No method, such as the mordanting of the fabrics, was used for preparing the paper for printing, because it was impossible to wet the paper and render it usable after it dried. Common clover was printed onto each type of paper. Only construction paper and art fabric paper produced desirable prints. Art fabric, being very absorbent, made the clearest, most effective print, but very little of the vein pattern of the leaf showed. A great deal of the vein pattern showed on prints made on construction paper, but the edges had a tendency to smear because the excess liquid pigment from the plant was not absorbed fast enough. Both papers were chosen for use in this study because it was hoped that each type of leaf would print effectively on at least one of the types of paper.

Because exposure to light of the sample prints made on untreated paper produced great color loss, a series of tests using commercially prepared fixatives was made to determine if any of them would add a degree of color fastness to the prints. When a suitable fixative for paper was tested, prints made on fabric were also treated because no positive results in previous color fastness tests had been noted with these prints. Investigation of available products revealed that two spray fixatives and one acrylic emulsion might produce positive results. Hair spray was also included in the testing because of its proven ability to preserve dried flowers.

Common clover was used, along with a variety of other plants, to produce sample prints. Completed prints made on both fabric and paper grounds were sprayed with each of the three fixatives. The emulsion was brushed on the sample paper prints. The hair spray was eliminated from further consideration because of bleeding of the plant color onto the surrounding background. The color of the prints was not changed by the initial application of any of the other products. To determine the usefulness of each product in preserving the color of the prints, one sample of each was retained for use as a control; for a period of seven days one sample was exposed to direct light; one was displayed in a semi-darkened room; and one sample was placed in a normally lighted room.

Artists water color was painted on samples of the construction and art fabric paper and were tested along with the plant prints. No fading of the water-color samples was noted.

Results of the comparison of the control samples with the exposed samples indicated that one commercial spray fixative provided no resistance to fading of the colors printed on either the fabric or paper ground. The brushed-on emulsion and one spray fixative provided a small degree of color fastness for prints made on both types of paper grounds. The fabric sprayed with the fixative showed the same results as the paper sprayed with fixative. The amount of color loss was proportionate to the intensity of the light the prints were subjected to. It was noted that all the different types of plant prints tested did not show the same degree of color loss. Individual tests would have to be made with each plant on each ground to determine the exact degree of color fastness of various prints. The purpose of this test was to determine the most permanent method of fixing the color of the plant print. Analysis resulted in the use of the spray fixative on all the samples and compositions displayed in Chapter III. Although the spray was of dubious value in providing color fastness, it was decided to use the fixative as a protective coating. Due to the stiffening effect of the fixative, the usefulness of the fabric was reduced to its employment solely as a flat background. The fixative should not be used on fabrics which need to be folded, sewed, cleaned or washed.

Procedure Used in Thesis

The discussion of the preliminary tests and the chronicling of the results that led to the basic procedure touches on all the tools, processes and supplies used in this study. This section establishes a step-by-step procedure for the printing of all the samples and compositions included in Chapter III.

The tools and supplies for making pounded prints were inexpensive and most were readily available locally. It was necessary to assemble the ones needed for each step before starting the process. The bleached cotton domestic and the wool crepe were purchased by the yard in a fabric shop or department store. Construction paper and art fabric paper were obtained from an art supply store.

Although rain water was considered best by most sources for use in mordanting, a constant supply was not available. To insure consistency of results, this study was carried out by using commercially distilled water. It was purchased at a grocery store where it is available in container sizes ranging from one-half gallon to five gallons.

A three-gallon enameled bucket was found to be large enough to successfully mordant four ounces of fabric at a time, yet it was small enough to be easily used on a kitchen range. The bucket, along with the glass stirring rod taken from a towel rack, the plastic measuring spoons and cup, and the glass cooking thermometer were purchased at a local variety store. Each item was carefully examined to make sure that no exposed metal could come in contact with the chemicals. Such contact would produce a corrosive reaction that would ruin both the mordant and the fabric.

Postal letter scales were used to weigh the chemicals and fabric used in this study. Any set of accurate scales that register fractions of an ounce would function just as well.

Potassium aluminum sulphate used in this study was purchased at a local commercial chemical supply company in pound lots. The cream of tartar was found on the spice rack at the local grocery store. The spray fixative was purchased from a local art supply dealer.

The tools needed for making the pounded prints could be found in most homes. The wax paper was the variety used in the kitchen. The metal claw hammer was the size and type used by carpenters and repairmen.

The successful employment of the mordant depended both on the preparation of the fabric and very accurate measuring and cooking of the mordant compound. To remove sizing from the cotton and the natural grease from the wool that would hamper the absorption of the mordant, the fabric was washed in two separate suds made by mixing two tablespoons of mild white soap flakes in a gallon of warm water, and was rinsed in clear water at least four times. This was done at any time before mordanting. The fabric was wet thoroughly before it was immersed in the mordant bath.

The directions from Kierstead's book, Natural Dyes, for preparation of the alum mordant needed to treat one pound of dry fabric were stated in the first part of the chapter.[20] For this study the amounts were reduced to one-fourth. All the fabric was mordanted in four-ounce lots, using one ounce

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[20]Kierstead, *op. cit.*, pp. 21-22.

of alum, one-fourth ounce cream of tartar and one and one-half gallons water.

The distilled water was placed in the enameled bucket before the cream of tartar and alum were added. The chemicals were dissolved by slowly warming the water. The washed fabric that had been wetted in clear water of the same warm temperature was completely submerged in the solution. The heat was allowed to continue rising until the solution was simmering. The water level was kept the same by adding more water of the same temperature. A constant temperature of 190 degrees Fahrenheit, registered by the cooking thermometer, was maintained for one and one-half hours. The glass rod was used to turn the fabric occasionally. The fabric was allowed to cool in the solution before being rinsed and dried. Before printing, the fabric was ironed and cut to the desired size.

The plant print was accomplished on both fabric and paper grounds by placing a sheet of wax paper over a pad of newspaper, followed by the dry, mordanted fabric and the plant part covered by a second sheet of waxed paper. The plant was then held in place and hammered evenly, with sufficient force to make the impression, but not enough to crush it out of shape. Progress of the print could be checked by carefully raising the edge of the waxed paper and a small area of the leaf. If necessary, the leaf could be tapped again with the hammer.[21] It was found that to work on a

[21] "Old Indian Craft Enhances Modern Decor," p. 16.

concrete surface, such as a porch, reduced the noise level considerably. The finished print was allowed to dry several hours before being pinned to a large cardboard and lightly sprayed twice with the fixative.

CHAPTER III

EXPERIMENTAL PLANT PRINTS AND ANALYSIS OF DESIGN POSSIBILITIES

For the artist-craftsman the technical exploration of his medium leads directly into the design aspect of the medium. The two, technique and design, are intimately bound together. Design used as a verb means the creative action that fulfills its purpose.[1] The first part of this study, the procedure described in Chapter II, explores the action necessary to produce a print. The second part, the design process described in this chapter, evaluates the design potential of the prints. The first section of this chapter deals with design theory, discussing the art elements and principles. The second section contains sample prints of individual plants, rates the quality of each print and evaluates the potential of each plant as a source for design elements. The last section contains and discusses compositions which utilize a number of elements combined according to the principles of design theory.

Design Theory

The art elements, line, form, space, texture and color, are the rudimentary building units of the visual world.

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[1]Robert Gillam Scott, Design Fundamentals (New York, 1951), p. 1.

These are combined to form the relationships that are known as the art principles: balance, continuity, and emphasis. The goal of the artist in using these principles is to produce unified variety in a total design.[2]

Line is a one-dimensional extension of a point.[3] It can, through variation or repetition, express an idea or feeling, determine direction or define a shape.

In design, form is a mass, shape or structure with a distinguishable boundary.[4] To produce a particular sensation or objective image, the boundary can be either varied and free or mechanically precise.

Space can be described as a pause or an open interval in the design.[5] When treated as an integral part of the total design structure, it can produce a sensation of depth, emphasize a particular form or direct visual movement.

The qualities of a visual texture are described in the same terms as are the textures that are perceived tactilely. The particular disposition of the hue, value or intensity that constitute a visual texture or the surface quality of a tactile texture can be described as slick, coarse, fine, smooth or varied.[6]

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[2]Ray Faulkner, Edwin Ziegfeld and Gerald Hill, Art Today (New York, 1956), p. 357.

[3]Ray Gough, "Introduction to Art Appreciation," unpublished lecture notes, Department of Art, North Texas State University, Denton, Texas, 1968.

[4]*Ibid.* [5]*Ibid.* [6]*Ibid.*

Color, the response of vision to radiant energy of certain wave lengths and intensities, has three qualities--hue, value and intensity. Hue is the name of the color and indicates its position in the visual spectrum. Value denotes the relationship of the color to darkness or lightness. Intensity describes the gradation of the purity, strength or saturation of the hue.[7]

The organization of the relationships between the art elements is guided by the principles. The first principle, balance, may be one of two kinds, symmetrical or occult. Symmetrical balance tends to be static and formal because each of the parts or accents is placed evenly on either side of a center point or axis. Occult balance is at the same time less mechanical, more subtle in construction and more dynamic in effect. It is successfully produced when unlike parts are arranged about a balancing point or axis and held in equilibrium by the "pull," by the fields of attraction and by the visual tensions.[8]

The second design principle, continuity, is the harmonious relationship of organized repetition, progression and purposeful accents. It is derived from, first, the patterns of expectedness set up by the repetition of one or more of the elements and, second, the dynamic force produced

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[7]Faulkner, op. cit., p. 337.

[8]Scott, op. cit., p. 36.

by increasing or decreasing one or more design quality. It generates vitality and intensity by emphasizing particular areas or aspects of the design while setting the mood of harmony and order by unifying the various parts of the composition.[9]

Emphasis, the third design element, captures interest and unifies the composition by directing vision to the areas of particular importance. This is accomplished either by the varying or contrasting of color and/or size relationships, or by the grouping or spacing of the elements in unusual or unexpected ways.[10]

Description of Experimental Plant Prints

The sample plant prints displayed in this section were made by the method described in Chapter II, arranged in alphabetical order by plant names and individually evaluated both for success in printing and for potential use as a design element. Although not every plant, shrub or tree common to the Dallas area was tested, the survey is broad enough to enable a comprehensive analysis to be made of the print making potential and design qualities of the pounding process. Of the seventy-eight varieties tested, forty-eight sample print plates are included for consideration. The name, both common and botanical, of each plant was verified in one of

[9]Faulkner, op. cit., p. 374.

[10]Ibid., p. 378.

the following authoritative sources: Flora of South Central Texas,[11] Know Your Grasses,[12] and The Standard Cyclopedia of Horticulture.[13]

Each plate is arranged to include the common and botanical name of the plant, a line drawing of the plant, a sample print made on each of the four ground materials and, finally, the evaluation charts. The first print chart on the plate evaluates the quality of the impression and the second chart analyzes the print in terms of design.

The print evaluation chart rates a print of each plant made on each of the four ground materials as to whether the quality of the impression is excellent, good, fair or poor. If two parts from the plant are printed on the same sample, the rating is based on the better print. A print, to be rated as excellent, must be an exact likeness of the plant part, and any unusual coloring or vein pattern must have been reproduced perfectly. A rating of good is given to prints that are of a clear, interesting shape and texture. In prints which rate as fair, all the liquid of the plant part was not absorbed by the ground, and the edges are not clearly defined. In some cases an interesting color, shape or texture was

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[11]R. G. Reeves and D. C. Bain, Flora of South Central Texas (College Station, Texas, n. d.).

[12]Hoffman, op. cit.

[13]L. H. Bailey, The Standard Cyclopedia of Horticulture (New York, 1958).

obtained, but the whole plant part would not transfer. These prints are considered usable but not completely satisfactory. If the color of the print was very weak, or if the plant part left a very vague impression, or if hammer marks were very obvious, the sample print received a rating of poor and was omitted from further consideration.

In the second chart, the prints are analyzed in terms of the design elements. No attempt is made to rate the individual usefulness of each plant; decisions as to usefulness of visual materials can be made only when a composition is being considered. This is illustrated by Plates 49-52. A uniform terminology is used to describe the color, texture, size and shape of the best print of each plant part.

The color description of each plant print was determined by comparing the print sample with the color charts in the *Reinhold Color Atlas*.[14] The exact color designation of the sample is indicated on the analysis chart by a number from the *Atlas*. This designating number is a composite of the color chart number followed by the letter of the vertical column which in turn is followed by the number of the horizontal row. Texture is described as being *coarse*, *fine*, *smooth* or *varied*. The terms *large*, *medium* or *small* designate the size of the plant part. *Small* designates the size of any leaf or petal under one and one-half inches in length. The term

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[14] A. Kornerup and J. H. Wanscher, *Reinhold Color Atlas* (New York, 1950).

medium is assigned to prints that are one and one-half to three inches in length. Any petal or leaf that measures longer than three inches is considered to be large.

Although many sources give scientifically accurate terms for leaf and petal shapes, this study uses terminology more commonly employed by designers to describe the shapes with which they work. The list of designations was abridged to include only elliptical, linear, round, irregular and oblique. These shapes indicated on the chart were used to describe the total feeling of the leaf or petal.

The flowers of several plants were not printed for various reasons. If the plant did not have a flower or if it was not suitable for printing the entry, none, was recorded on the design element chart. If the leaf was printed at a time when the flower was not in bloom, the entry, not in season, was recorded. Some plants which have a white flower have the entry, white, listed in the column headed flower. No prints of white flowers were made.

The sample prints, made using the method discussed in Chapter II, are arranged alphabetically by the botanical name of the plant and displayed immediately following this page on plates that are numbered 1-48. The information accumulated from the individual charts is discussed later in this chapter.

The group of plants that did not produce successful prints when untreated leaves were tested on each of the four

Plate 48--Wisteria sinensis, the wisteria

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30D4	Not in season
Texture	Fine	
Size	Medium	
Shape	Oblique	.

Plate 1--Avena satvia, the oats

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X	X		
Fair			X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	28E7	None
Texture	Varied	
Size	Large	
Shape	Linear	

Plate 2--Berberis alrocarpa, the barberry

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X	X		
Good			X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	11B4	None
Texture	Varied	
Size	Small	
Shape	Round	

Plate 3--Callirhoe involucrata, the wine-cups

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X		
Fair			X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30E8	16D5
Texture	Fine	Fine
Size	Small	Small
Shape	Irregular	Irregular

Plate 4--Castilleja indivisa, the scarlet paintbrush

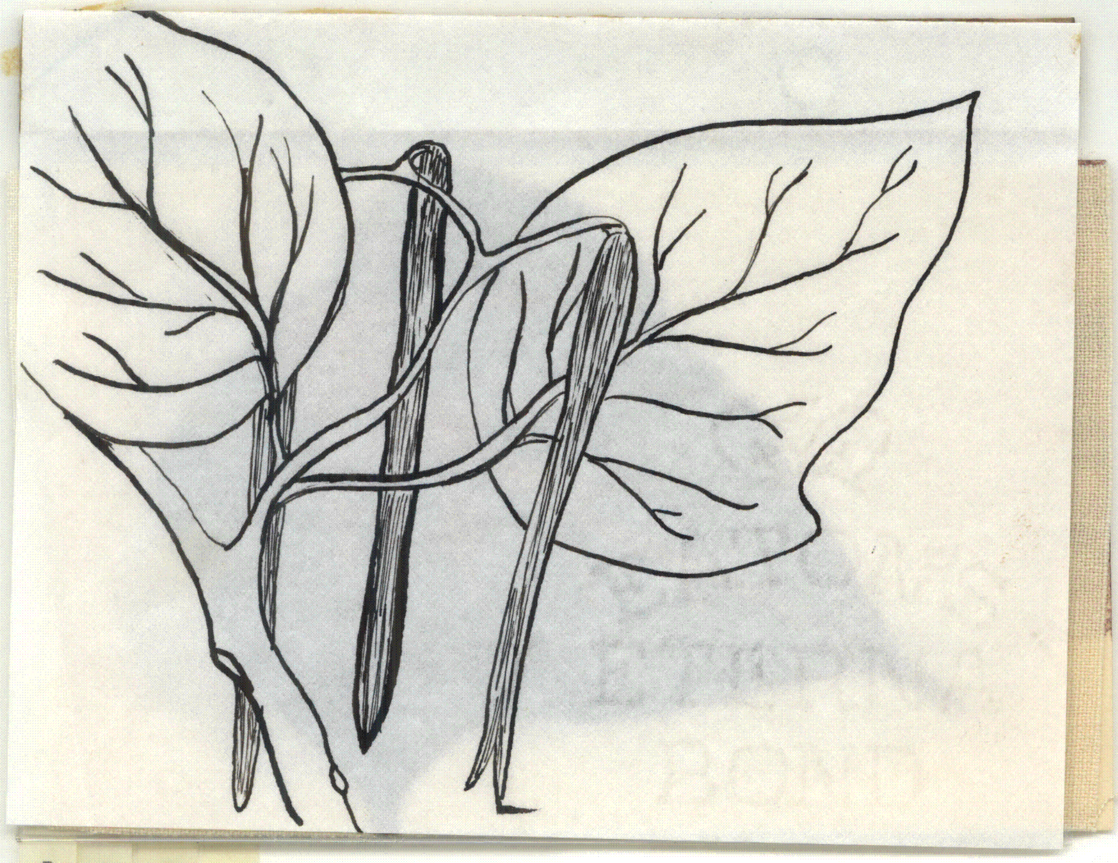
Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X	X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	10B4	None
Texture	Fine	
Size	Small	
Shape	Irregular	

Plate 5--Catalpa bignonioides, the Western catalpa tree



1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X	X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30F7	White
Texture	Varied	
Size	Large	
Shape	Oblique	

Plate 6--<u>Chrysanthemum</u> <u>hortorum</u>, the chrysanthemum

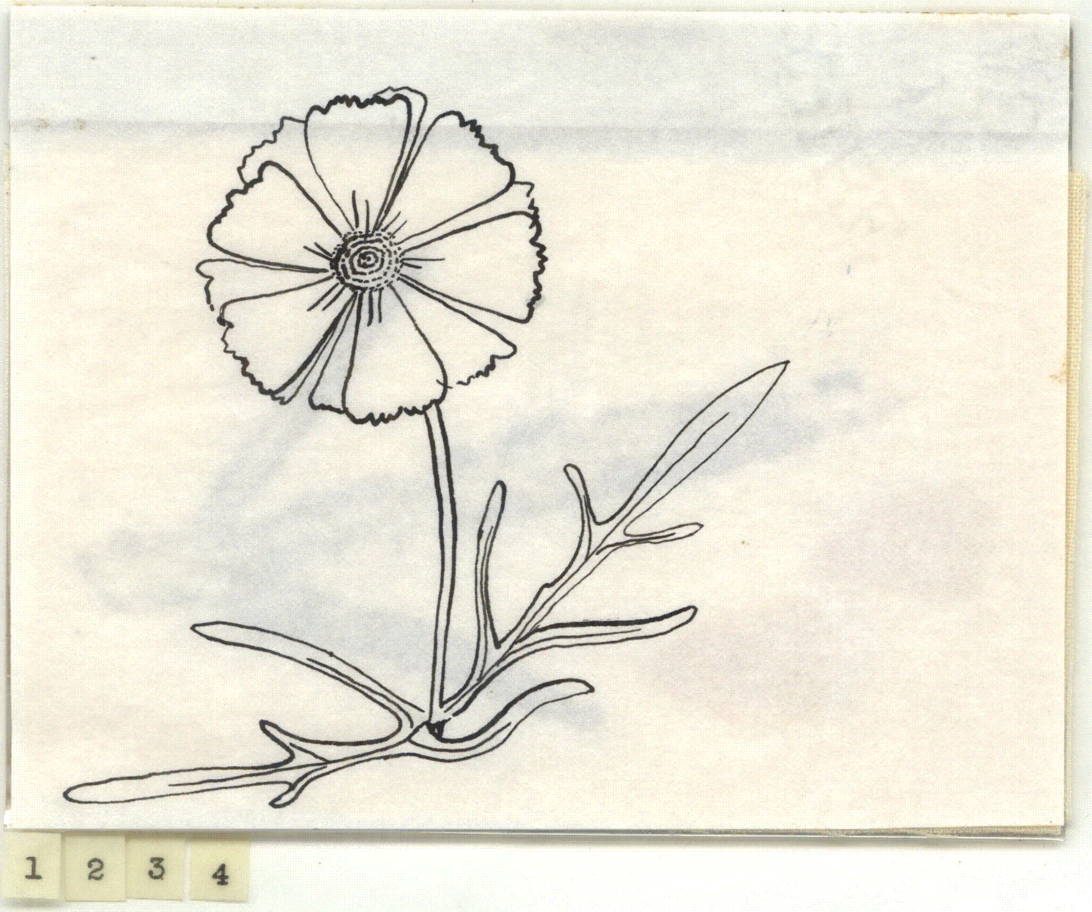
Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair			X	
Poor		X		X

Design Analysis

Design Element	Leaf	Flower
Color	30E5	Not in season
Texture	Fine	
Size	Medium	
Shape	Irregular	

Plate 7--Coreopsis delphinifolia, the coreopsis



Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E6	3A6
Texture	Varied	Fine
Size	Large	Small
Shape	Linear	Irregular

Plate 8--Coreopsis nuecensis, the coreopsis

Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent				
Good	X	X	X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29E6	4B8
Texture	Fine	Fine
Size	Medium	Small
Shape	Irregular	Irregular

Plate 9--Cornus florida, the flowering dogwood tree

Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30B5	White
Texture	Coarse	
Size	Medium	
Shape	Oblique	

Plate 10--Delphinium ajacis, the larkspur

1 2 3 4

Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E8	19B7
Texture	Fine	Coarse
Size	Medium	Small
Shape	Irregular	Round

Plate 11--Dianthus barbatus, the sweet william

Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29D6	15E5
Texture	Fine	Fine
Size	Medium	Small
Shape	Linear	Irregular

Plate 12--Engelmannia pinnatifida, the cut-leaved daisy

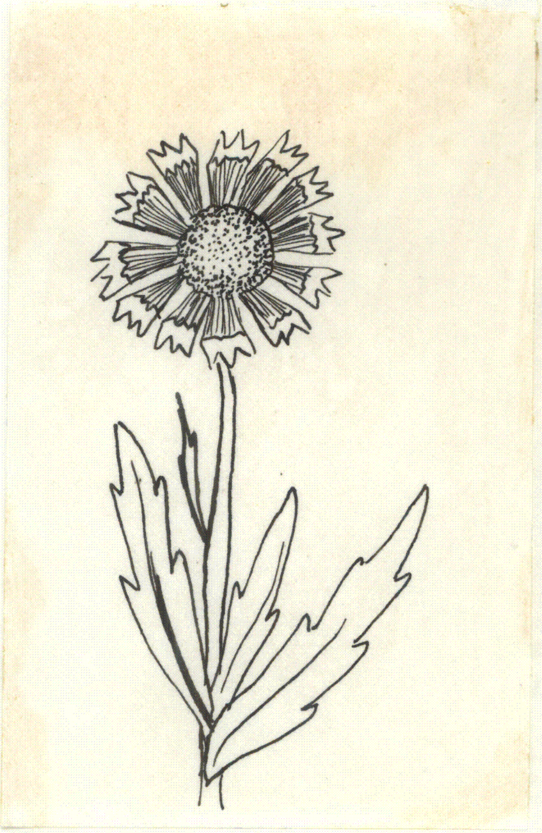
Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	3B4	3B7
Texture	Varied	Fine
Size	Medium	Small
Shape	Irregular	Elliptical

Plate 13--Gaillardia pulchella, the fire-wheel



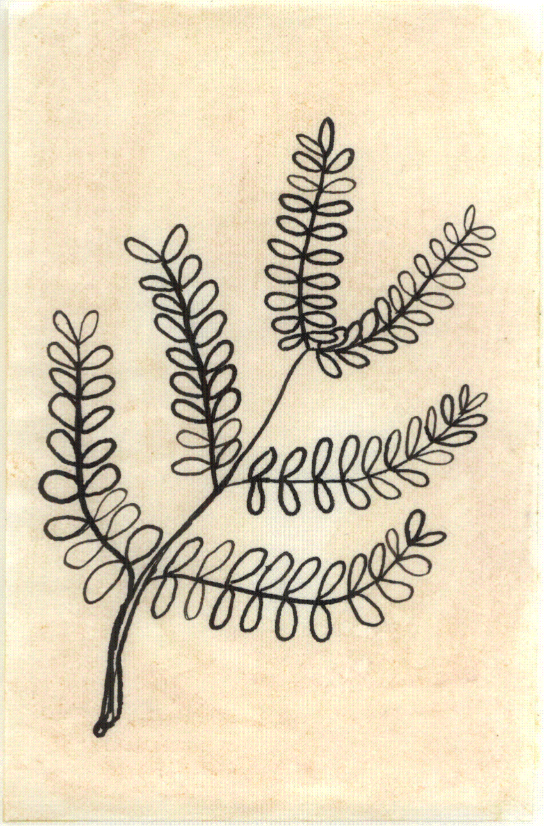
Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E6	11D6
Texture	Varied	Coarse
Size	Medium	Small
Shape	Oblique	Irregular

Plate 14--Gleditsia triacanthos, the honey locust tree



Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent				
Good				
Fair	X	X		
Poor			X	X

Design Analysis

Design Element	Leaf	Flower
Color	30E6	None
Texture	Varied	
Size	Small	
Shape	Oblique	

Plate 15--Halianthus annuus, the sunflower

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E6	3A5
Texture	Varied	Varied
Size	Large	Small
Shape	Oblique	Oblique

Plate 16--Hibiscus syriacus, the althaea

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30C6	Not in season
Texture	Fine	
Size	Medium	
Shape	Oblique	

Plate 17--Juglans nigra, the black walnut

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X		
Poor			X	X

Design Analysis

Design Element	Leaf	Flower
Color	3E5	None
Texture	Coarse	
Size	Large	
Shape	Oblique	

Plate 18--Krigia occidentalis, the dwarf-dandelion

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E7	Not in season
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 19--Lilium tigrinum, the tiger lily

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C6	19C4
Texture	Fine	Fine
Size	Large	Large
Shape	Linear	Elliptical

Plate 20--<u>Lonicera japonica</u>, the honeysuckle

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30E5	White
Texture	Varied	
Size	Medium	
Shape	Elliptical	

Plate 21--Lupinus texensis, the bluebonnet

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C5	19B6
Texture	Fine	Fine
Size	Small	Small
Shape	Irregular	Irregular

Plate 22--Lycopersicum esculentum, the tomato

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good				
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E4	None
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 23--<u>Melia azedarach</u>, the chinaberry tree

Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent	X	X		
Good			X	X
Fair				
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29E8	Not in season
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 24--Mentha spicata, the mint

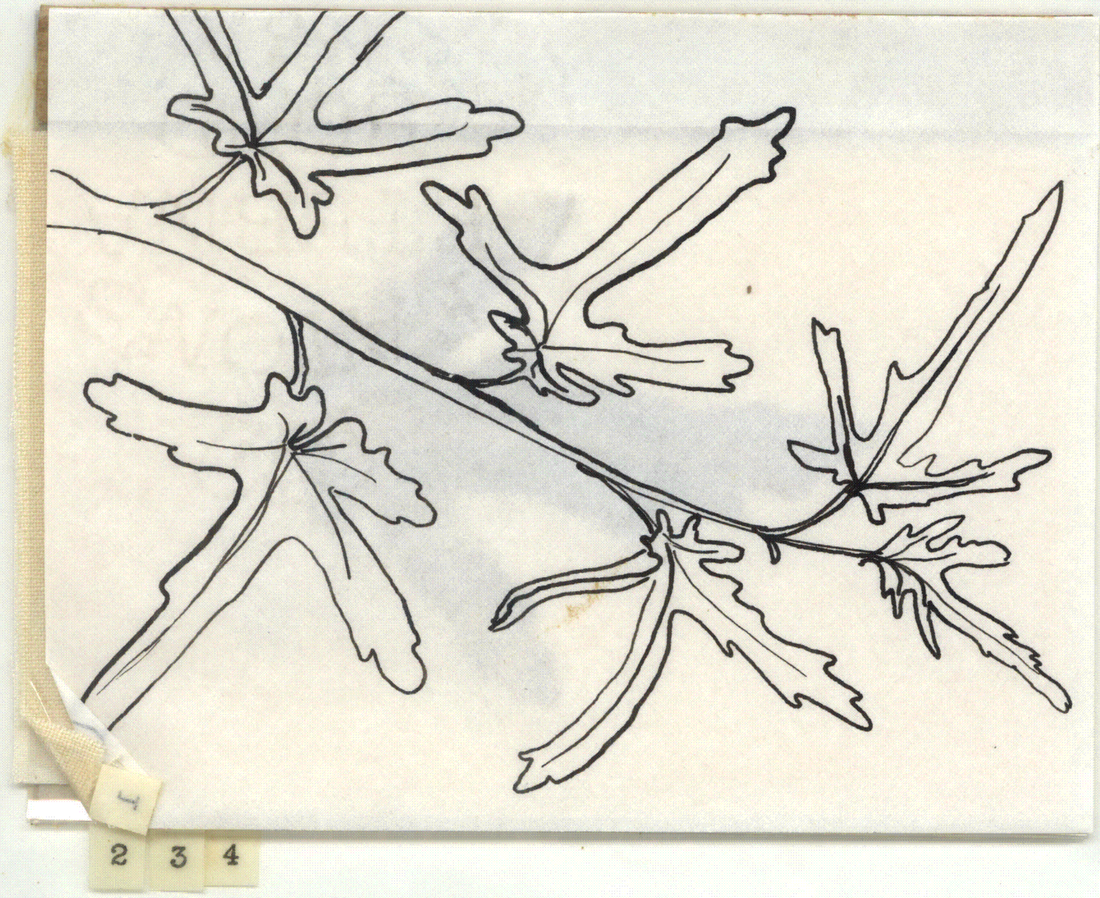
Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good		X	X	
Fair	X			X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	4E6	None
Texture	Varied	
Size	Medium	
Shape	Oblique	

Plate 25--Morus rubra, the red mulberry tree



Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent	X			
Good			X	
Fair		X		X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E8	None
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 26--Oxalis violacea, the purple wood-sorrell

1 2 3 4

Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent	X			
Good		X		
Fair			X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	1D5	Not in season
Texture	Fine	
Size	Small	
Shape	Round	

Plate 27--<u>Paeonia festiva</u>, the peony

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X		
Fair			X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E8	White
Texture	Fine	
Size	Large	
Shape	Oblique	

Plate 28--*Papaver rhoeas*, the poppy

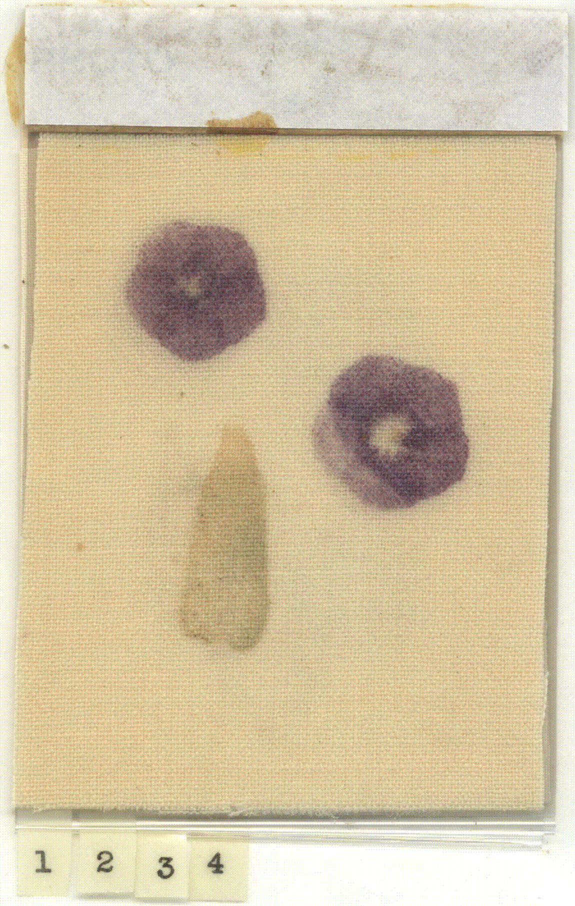
Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C4	12B3
Texture	Fine	Coarse
Size	Large	Small
Shape	Linear	Elliptical

Plate 29--<u>Phlox</u> <u>amoena</u>, the phlox



Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29C4	17D6
Texture	Varied	Fine
Size	Small	Small
Shape	Oblique	Round

Plate 30--Phlox tenuis, the annual phlox

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good				
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E8	17B4
Texture	Fine	Fine
Size	Medium	Small
Shape	Linear	Round

Plate 31--Prosopis chilensis, the mesquite tree

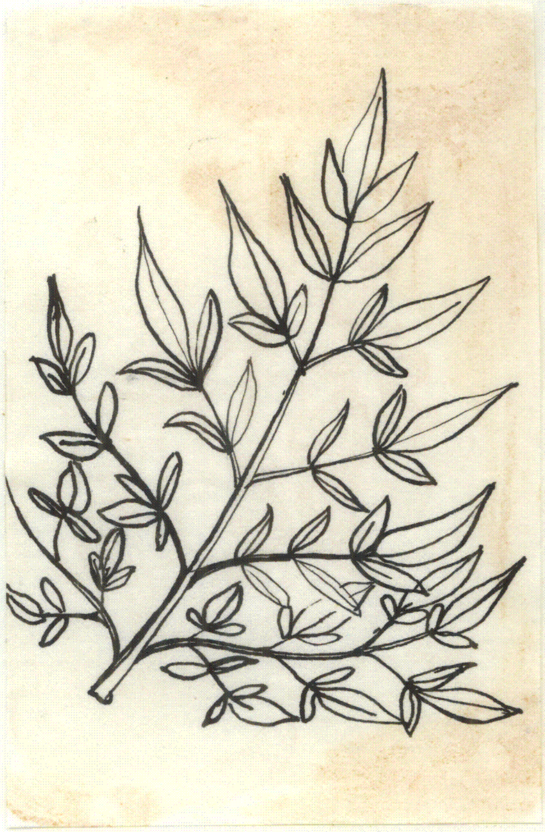
Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent	X			
Good		X	X	
Fair				
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	29C8	None
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 32--*Pyracantha coccinea*, the scarlet firethorn



1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X	X		
Good			X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	13C4	None
Texture	Varied	
Size	Medium	
Shape	Irregular	

Plate 33--Pyrus communis, the pear tree

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X			
Poor		X	X	X

Design Analysis

Design Element	Leaf	Flower
Color	30D6	Not in season
Texture	Coarse	
Size	Large	
Shape	Round	

Plate 34--Pyrus halliana, the crab apple tree

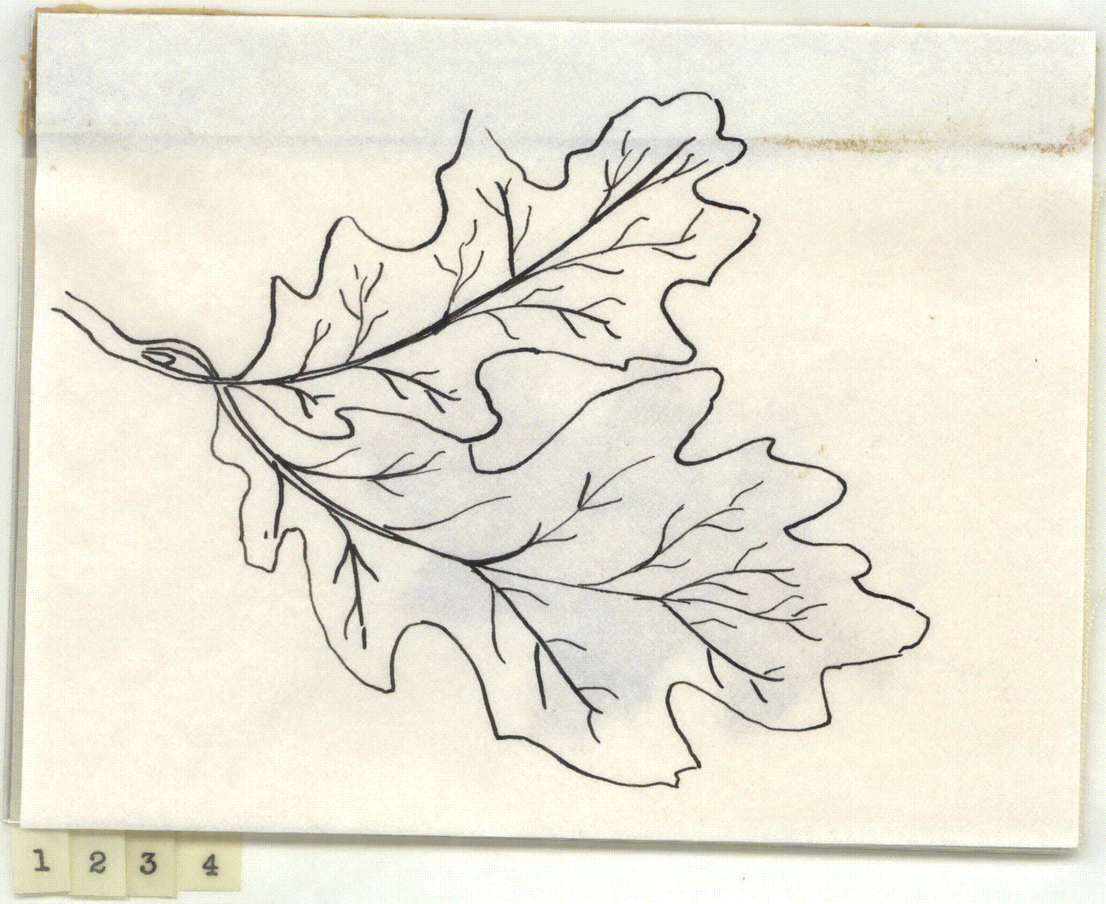
Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	3D3	Not in season
Texture	Varied	
Size	Medium	
Shape	Oblique	

Plate 35--Quercus rubra, the red oak tree



Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good		X		
Fair	X			
Poor			X	X

Design Analysis

Design Element	Leaf	Flower
Color	30C6	None
Texture	Fine	
Size	Large	
Shape	Irregular	

Plate 36--Rhus copallina, the shining sumac

Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30E7	None
Texture	Fine	
Size	Large	
Shape	Linear	

Plate 37--<u>Rosa hybrida</u>, the climbing red rose

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	29D6	13D6
Texture	Varied	Fine
Size	Medium	Medium
Shape	Round	Round

Plate 38--Rudbeckia amplexicaulis, the cone-flower

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	3E5	4A6
Texture	Varied	Fine
Size	Medium	Small
Shape	Oblique	Elliptical

Plate 39--<u>Sisrinchium</u>, the blue-eyed grass

Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent	X			
Good		X		
Fair			X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	2D7	21B5
Texture	Fine	Fine
Size	Large	Small
Shape	Linear	Round

Plate 40--Solanum carolinense, the horse nettle

1 2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good				
Fair	X	X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30E7	5C5
Texture	Varied	Coarse
Size	Large	Small
Shape	Irregular	Round

Plate 41--Thelesperma trifidum, the thelesperma

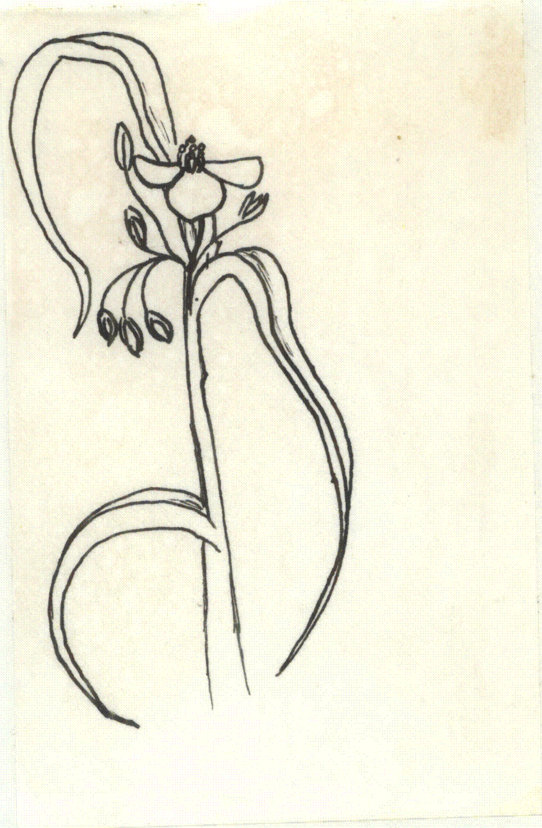
Print Evaluation

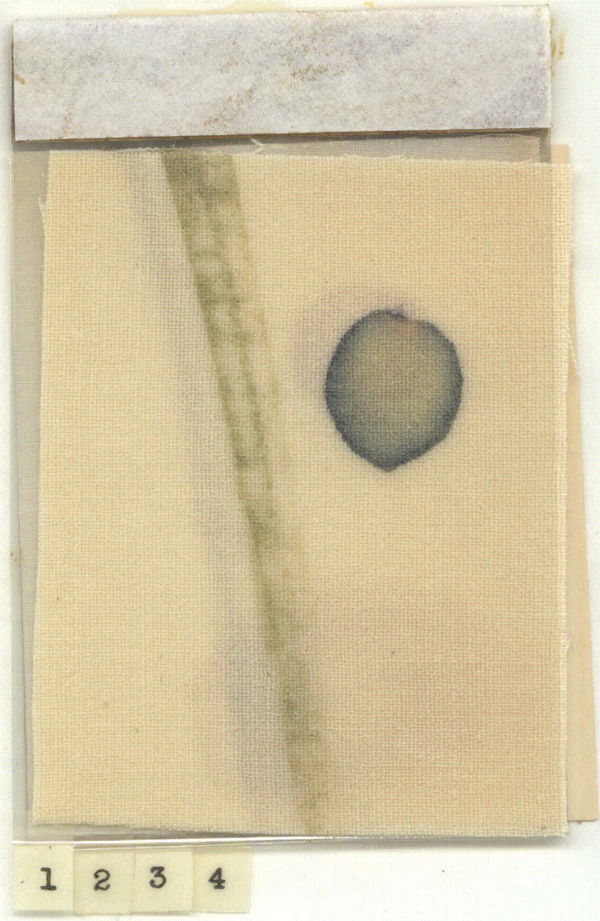
Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X		
Fair			X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	4E8	3A7
Texture	Varied	Fine
Size	Medium	Small
Shape	Irregular	Irregular

Plate 42--Tradescantia ohiensis, the spiderwort





Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C6	22B4
Texture	Varied	Smooth
Size	Large	Small
Shape	Linear	Round

Plate 43--Trifolium hybridum, the clover

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X	X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29E8	None
Texture	Fine	
Size	Small	
Shape	Irregular	

Plate 44--Verbena bipinnatifida, the prairie verbena

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent	X			
Good		X	X	
Fair				X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C6	19A4
Texture	Fine	Fine
Size	Medium	Small
Shape	Irregular	Irregular

Plate 45--Verbena hybrida, the verbena

Print Evaluation

Print Quality	Ground 1	Ground 2	Ground 3	Ground 4
Excellent				
Good	X	X		
Fair			X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	30C5	12C6
Texture	Fine	Fine
Size	Small	Small
Shape	Oblique	Irregular

Plate 46--<u>Vinca</u> <u>major</u>, the vinca

1 2 3 4

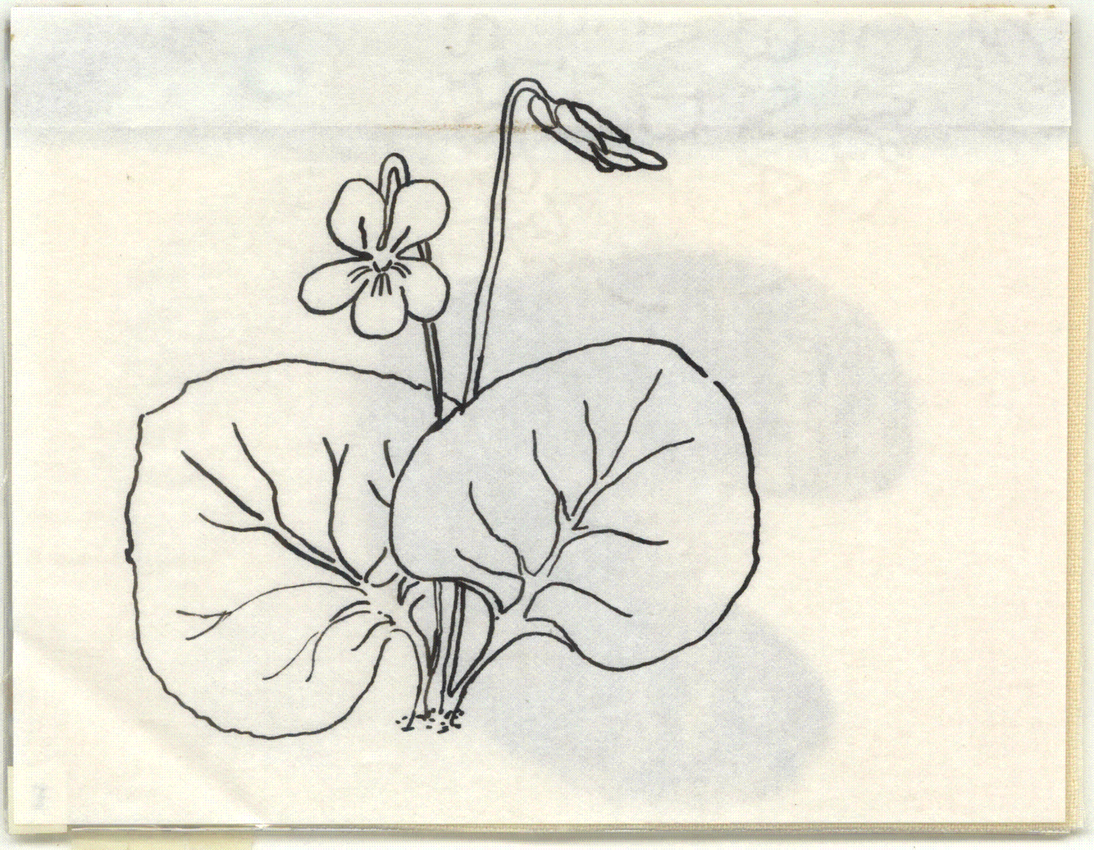
Print Evaluation

Print Quality	Ground			
	1	2	3	4
Excellent				
Good	X			
Fair		X	X	X
Poor				

Design Analysis

Design Element	Leaf	Flower
Color	29F8	Not in season
Texture	Fine	
Size	Medium	
Shape	Elliptical	

Plate 47--<u>Viola</u> <u>odorata</u>, the violet



2 3 4

Print Evaluation

Print Quality	Ground 1	2	3	4
Excellent				
Good	X			
Fair		X	X	
Poor				X

Design Analysis

Design Element	Leaf	Flower
Color	30D6	Not in season
Texture	Fine	
Size	Medium	
Shape	Round	

grounds is included to complete the surveyed list. In order to determine if these plants would produce successful impressions under any circumstances, either a series of prints would have to be made during the span of the growing season, or the ether method would have to be tried individually on each plant. Inasmuch as the purpose of this study was to determine if the method of print making employed would provide enough variety in the visual elements to serve as a useful design medium it was deemed unnecessary to produce a successful print from each plant type. The following plants were tested and proved unsuccessful at the time of testing:

1. *Carya illinoensis*, the pecan;
2. *Celtis occidentalis*, the hackberry;
3. *Cenothera speciosa*, the pink evening primrose;
4. *Cercis canadensis*, the redbud;
5. *Chaenomeles japonica*, the japonica;
6. *Cynodon dactylon*, the Bermudagrass;
7. *Ficus carica*, the fig;
8. *Fragaris chiloensis*, the strawberry;
9. *Juniperus virginiana*, the red juniper;
10. *Lagerstroemia indica*, the crape myrtle;
11. *Ligustrum corisceum*, the wax leaf ligustrum;
12. *Lindheimera texana*, the Texas star;
13. *Lithospermum incisum*, the puccoon;
14. *Maclura pomifera*, the bois d'arc;
15. *Magnolia grandiflora*, the Southern magnolia;

16. Morus rubra, the red mulberry;
17. Platanus occidentalis, the sycamore;
18. Populus deltoides var. virginiana, the Eastern cottonwood;
19. Populus nigra var. italica, the Lombardy poplar;
20. Prunus armeniaca, the apricot;
21. Prunus caroliniana, the mock orange;
22. Prunus domestica, the plum;
23. Prunus persica, the peach;
24. Prunus salicina, the Japanese plum;
25. Punica granatum nana, the pomegranate;
26. Quercus macrocarpa, the bur oak;
27. Salix blanda, the weeping willow;
28. Salvia azurea, the blue sage;
29. Sorgham halepense, the Johnsongrass;
30. Ulmus americana, the American elm.

As a group, the successful prints produced a varied range of colors and represented all the types of texture, size and shape. This variety in the design elements, together with the success of the prints on the four grounds, showed the versatility of the craft as a design medium.

The majority of the sample prints were rated as being good or fair, while a few were given a rating of excellent. Some proved to be completely unusable and were rated as poor. The wool crepe consistently proved to be the best ground for prints by producing impressions of good color and detailed texture. The prints made on the art fabric and the bleached cotton domestic generally received a rating of good or fair; this rating established both as useful grounds. Even though the construction paper proved to be the least successful of the four grounds, a few prints made on this ground received a rating of good, and many are considered usable because of their being rated as fair. A color change from red to blue was noted when some red petals produced blue prints on the construction paper. This difference between the color of the print and the plant part is attributed to the commercially applied chemical finish on the ground.

Color of the prints showed variety of hue, value and intensity. Neither the full intensity nor the darkest value of any hue was produced with any plant part on any ground. Most of the colors proved to be both grayed and lightened when compared with the purest hues illustrated in the *Reinhold Color Atlas*.[15] The white or near white ground provided the visual contrast necessary to intensify all the hues.

The textures produced within the boundary of the shape, ranged from smooth to coarse. Many prints, by showing color variation between the principal veins and the petal or leaf part, produced a very pleasing and varied texture.

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[15]*Ibid*.

Although names of the shapes used on the chart indicate the total feeling of the plant part, each plant contributes a uniquely individual shape that could be repeated or combined with the other plant shapes to produce many variations in the composition. Even though the larger, older leaves of most plants were less successfully used in making prints when compared to the smaller leaves of the new growth, the variations between plants was sufficient to establish a full range of size.

In general, the plants that grow nearest the earth and do not have a woody stem made the best prints. New growth of any plant, particularly that of the woody stemmed plants, produced the best prints. Trees, with a few exceptions, made the least successful prints.

While the preliminary tests to determine the procedure were being carried out and while the sample prints were being made, three variables that determined the quality of the prints were noted. First, in the initial tests that spanned a period of several weeks, the best prints from the clover were obtained during the peak growing season of the plant. Determining the proper force to use in hammering the plant part into the ground constituted the second variable. Some plant parts, particularly those from woody stemmed plants, required much more force than did flower petals or the leaves from non-woody plants. Third, while making the sample prints, variations in both the quality of the impression and in the value and intensity of the hue were experienced by using the same plant part on each ground.

Four compositions were made using each of the grounds and some of the plant parts that provided a rating of good or excellent on the print evaluation chart. They are presented to illustrate the variety of organizations possible using the elements guided by the design principles discussed earlier in the chapter.

Plate 49--Wine-cups used on wool ground

The first composition uses the petals and leaves of the wild flower, wine-cups, on a wool ground. The lacy pattern of the leaf shape contrasts with the more definitely defined shape of the petal. As proved by the comparison of the sample print with the color chart, the green is more intense, and both hues are grayed. Nevertheless, the purple hue provides color emphasis because of the advancing quality possessed by any mixture of red. The occult balance of the composition is achieved by the close grouping toward the right of the shapes which are emphasized by the varied spacing and the visual, circular flow of the elements.

Plate 50--Catalpa and mesquite leaves used on cotton ground

The bleached cotton domestic was used for the ground of the second composition. The varied sizes of the leaves from the catalpa tree and the rhythmic repetition in the segments of the linear leaves of the mesquite tree provide contrast in size, shape and texture.

Color and texture variations are found within the boundary of the individual catalpa leaf and are produced by the overlapping of both leaf shapes. Visual interest is obtained by the close grouping at the bottom of the composition and by the varied spacing of the elements at the top. Emphasis was produced by placing the mesquite leaves so as both to fill the blank space at the right and to connect the large areas produced by the catalpa leaves.

Plate 51--Oats used on art fabric ground

The stark linear quality and strong color contrast of the foliage of the grain plant, oats, used on the art fabric ground illustrates the importance of spacing in the total design of the third composition. Because the line segments enclose the ground space in several places, the space becomes a triangular shape and the focal point of interest in the composition. The eye is drawn to these ground shapes by the linear segments that taper inward from all sides. Emphasis is further achieved in this area by the overlapping and conjuncting of the segments. Although there is some texture both within the boundaries of the shape and in the overlapping areas of the segments, shape, color and spacing are the elements that produce the dramatic force in the composition.

Plate 52--Chinaberry leaves used on construction paper ground

The last composition illustrates that pleasing effects can be obtained on the construction paper ground. The small segments of leaves combine naturally to form a unit in the composition. Variety is derived from the natural spacing, color and texture produced in the print. The spacing of the three units of the composition brings the eye from the edge, to the tip of the shape and on to the next shape. The large unit at the bottom is balanced by both the empty space and the two smaller units at the top of the page. The interest in the composition is achieved by the balance and the progression of the unit sizes. Harmony is derived from the repetition of the same shape, color and texture.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The little known method of imparting an imprint of the color, texture and shape of plant parts directly onto fabric and paper was explored and developed in this study. To test and evaluate more accurately each aspect, the problem was divided into two parts. The first part determined, by evaluating a series of tests, the mechanical procedure used to make the sample prints and compositions found in Chapter III. The design aspect of the problem was explored in the second part by defining the elements and principles of design theory, by evaluating the usefulness of the sample prints as design elements according to the principles of design theory. Some limitations inherent in the medium developed through testing; others, such as the limiting of the geographical area, the calendar season, the mechanical process employed and the fabric and paper grounds, were set to allow time for a thorough analysis of the design possibilities.

The procedure used in the study was determined by investigating the technique of manipulating tools, by testing suitable fabrics and papers for use as grounds, by determining which chemicals would facilitate the printing process, and by experimenting with ways to preserve the finished design. Of the fabrics and papers tested, four which accepted the clearest and most intense prints were selected for use. These were cotton domestic, wool crepe, construction paper and art fabric paper. The use of an alum mordant on both the cotton and wool fabrics facilitated the printing of the plant parts. No similar treatment was discovered to prepare the paper for printing. The printing potential of one variety of leaf that had previously proved to be an unsuccessful print source was improved by soaking it first in ether; it printed well on all four grounds. The method of pounding the plant parts onto the grounds was the one described in the article found in Friends magazine.[1] A stack consisting first of a pad of paper, followed by a layer of wax paper, the ground, the plant part and a covering of wax paper was placed on a smooth hard surface and pounded with a metal claw hammer until the plant part made an impression on the ground. The print was allowed to dry before being sprayed lightly twice with a commercial fixative.

The second part of the study reports the design potential of the medium based on the art elements--line, form, space, texture and color--which are discussed, along with the art principles, in the section of Chapter III devoted to design theory. Sample plant prints were made by using the procedure

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[1]"Hammered Prints in Leafy Patterns," Friends, XXXI (August, 1965), 28.

described in Chapter II. Each print is displayed as an individual plate arranged in alphabetical order with the other plant prints and was evaluated in chart forms both for success in printing and for its potential use as a design element. The first chart on each plate indicates whether the print of each plant made on each of the four ground materials was rated as being excellent, good, fair or poor. The second chart describes the color, texture, size and shape of the best print of each plant part. Four compositions, using each of the grounds and some of the plant parts that provided good or excellent sample prints, were made to illustrate a variety of organizations of the elements guided by the principles of design.

Conclusions

The method of printing the color, texture and shape of plant parts directly onto fabric and paper is a successful and usable design tool, even though the lack of color permanence of the print limits its versatility. The process as described in more detail in National 4-H News used only leaves of plants on a cotton ground.[2] This thesis expanded the process to include the use of both leaves and flowers on three additional grounds: wool crepe, construction paper and art fabric paper. Tests proved that the use of an alum

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[2]"Old Indian Craft Enhances Modern Decor," National 4-H News, XLVI (June, 1967), 16.

mordant facilitated the printing potential of both fabrics and that the ether method provided a way to print successfully a leaf which had earlier proved unusable. The survey of seventy-eight Dallas area plants proved that local plants would provide the variety of visual elements needed to form interesting compositions.

The negative results of all methods tested to provide any degree of color fastness for finished prints was the only limitation of the study. The fugitive nature of the natural vegetable dyes when exposed to strong light ruled out the possibility of displaying the plant prints as one might display prints made in other media. But it is felt that the color fastness limitation is more than counterbalanced by a number of advantages, such as, the ready availability of plants, the nominal cost of supplies, the short time required to accomplish the printing and the variety of visual elements obtainable.

Recommendations

Based upon information gained from test results and observations made while working with the medium, some recommendations can be made both for potential uses of the process and for areas of study which would further improve the method. Because of the simplicity of the process, the availability of a variety of plants at almost any season of the year and the nominal cost of the tools and supplies, the method could prove very useful for teaching design fundamentals in a classroom situation. Many of the inhibitions commonly noted among students, such as a hesitancy to produce visual images in media such as paint, crayon or ink, would be overcome by the manipulation of the plant parts. The emphasis of the assignment could be placed on identifying and combining the design elements found in the plants. Also, when combined with a botanical study of plants, this medium would call attention to the structure of individual types of plants inasmuch as the printing process emphasizes the vein pattern, color, texture and form characteristic of the plant. Because the prints, when exposed to light for only short periods of time, hold their color longer than fresh leaves, prints made from plant parts would allow more time to compare, study, classify and discuss a variety of plant types.

This process is also recommended as a design tool for use in other media such as wood-block and lithographic printing, or it may be used as an intermediate step in producing compositions which would be photographically reproduced. The printing of the plant parts onto a ground produces variations of color and texture not seen when observing the original plant.

Further testing of plants that did not produce successful impressions during the conduct of this study is recommended. These tests would determine whether use of the ether method with some plants would improve the impressions. Test samples made over an extended time span of the growing season might also indicate differences in the quality of prints made from certain plants.

It is proposed that individual testing of fabrics which are made of synthetic fibers or blends of pure and synthetic fibers would widen the range of usable grounds. It is further proposed that laboratory testing by a qualified chemist could produce a substance which would permanently set the color of the prints on the grounds. It is hoped that such a substance will be produced and made available commercially at some future time. With a permanent color fixative that would allow plant prints to be used in the same manner as prints made with other media on paper and cloth, the method of printing developed in this study would open an entire new range of design possibilities in addition to being a creative designing and teaching tool.

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