1980

The Use of the Blueprinting Process on Fiber

Lisa D. Larson
Eastern Illinois University

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THE USE OF THE

BLUEPRINTING PROCESS ON FIBER

(TITLE)

BY

LISA D. LARSON

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF ARTS IN ART

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1980
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THE USE OF
THE BLUEPRINTING PROCESS
ON FIBER

BY

LISA D. LARSON

B.A. in Visual Communications, Eastern Illinois University, 1979

ABSTRACT OF A THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Art at the Graduate School of
Eastern Illinois University

CHARLESTON, ILLINOIS
1980

This thesis is a summary of what one student has done with the process of blueprinting as applied to fiber. Persons interested in the dyeing or painting of warps for weaving may benefit in reading this paper as it introduces another facet of warp application.

The blueprinting process used is the same technique engineers use to reproduce plans and drawings. It is a nonsilver photographic technique that makes use of ferric salts which, when mixed with certain other chemicals and exposed to ultraviolet light, form a colored by-product.

The research was begun with the study of the application of the chemicals to fabric. Later work was done to achieve a satisfactory process for applying the chemicals to a warp and exposing the warp in preparation for weaving. This was the main goal in working with the blueprinting process. Included in the thesis are photographs of the process and the finished experiments.

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INTRODUCTION

Blueprinting, the ferroprussiate process, or the cyanotype process, is the same technique engineers use to reproduce plans and drawings. Sir John Herschel, a British astronomer and physicist, discovered the process in 1842. It is a non-silver photographic technique. Blueprinting makes use of ferric salts which, when mixed with certain other chemicals and exposed to ultraviolet light, form a colored by-product. This blue by-product remains on all exposed areas of the sensitized surface.

Processes of blueprinting on fiber have been explored. The research started with the study of the application of the chemicals to fabric. Later work was done to achieve a satisfactory process for applying the chemicals to a warp and exposing the warp for weaving. This was the main goal in working with the blueprinting process.

EXPERIMENTS ON FABRIC

The use of blueprinting chemicals was first used as a printmaking technique in this study. The dominant interest was in textiles and exploring printmaking processes that would allow working with fabric. The exploration began with the use of blueprinting chemicals applied to cotton fabric. Natural materials such as weeds and foliage were used to create images and some interesting results were obtained.

The chemicals used are potassium ferricyanide and ferric ammonium citrate. (Plate #1) They may be purchased in crystal or powder form. To prepare the chemicals, dissolve 1/2 ounce of potassium ferricyanide in one cup of water in a glass jar. Then add one ounce of ferric ammonium citrate and stir until it is completely dissolved. The solution should be strained to eliminate any lumps. Rubber gloves should be worn while working with the chemicals. The chemicals should be prepared away from any strong ultraviolet light sources such as the sun. Once the chemicals are mixed together, they are sensitive to ultraviolet light and should be stored away from it.

The chemicals were applied with a brush to washed 100% white cotton material padded underneath with newspapers. This turned the fabric yellow-green. Foliage and weeds were laid on the sensitized fabric and pinned down through the material and into the cardboard underneath to hold them in place. The fabric was carried out into bright summer sunlight. The material turned blue and then brownish green as it dried and developed. This took approximately fifteen minutes. The print was carried inside, the pins and natural materials were removed, and it was rinsed under water several minutes until the water ran clear and the white areas of the print lost all their yellow tinge from the chemicals.

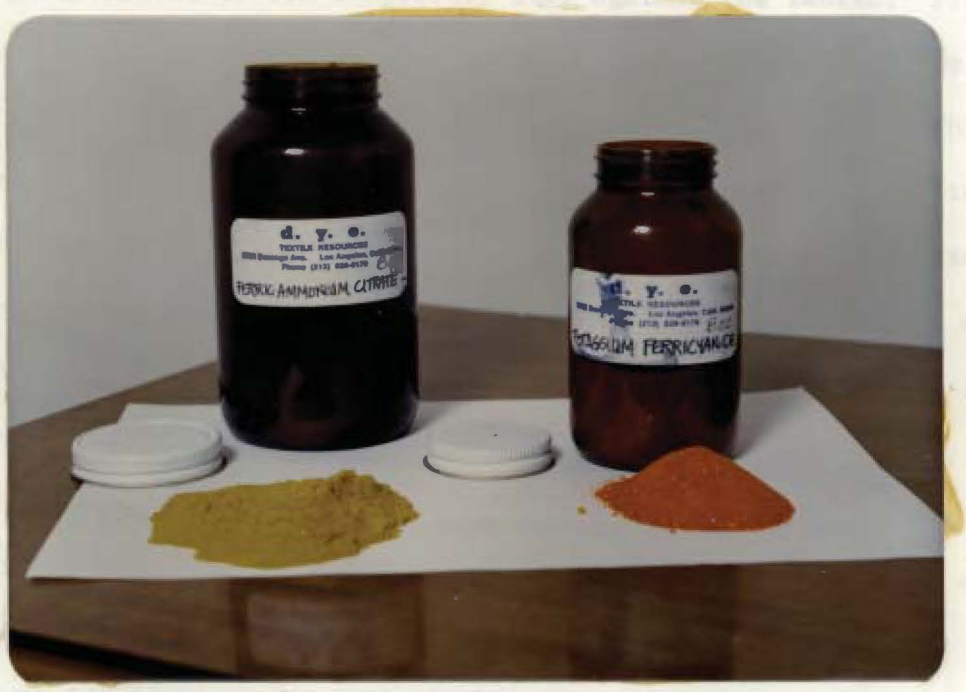

Plate #1

Chemicals

Various temperatures of water were used for the rinsing; the temperature did not seem to be critical. The rinsing washed out all unexposed chemicals and fixed the print. All the areas exposed to the sun turned blue leaving a white image on a blue background. (Plate #2)

Using pins to hold objects in place during the exposure was not always satisfactory. In order for the print to be in complete focus, the objects needed to lie completely flat against the fabric. Pins did not always hold them flat. The pins were replaced with a sheet of glass. The glass was placed over the objects and sensitized material. During the exposure, the water from the chemicals on the fabric evaporated and caused condensation on the glass. This caused an interesting textural quality on the print. This patterning was more interesting when asparagus fern was placed on the print. Water droplets formed on the fern and created very delicate dew-like images on the print. However, a method was not found to control the condensation and sometimes so much water built up on the glass that it fell back onto the print and diluted the chemicals causing a blotch.

Experiments were also made with large photographic negatives prepared for this purpose. It is not possible to project an image from a negative onto the sensitized fabric for the enlargement without altering the enlarger by placing an ultraviolet light source in it. Only contact printing was used during this research, so large negatives were necessary. Using a negative over the fabric dampened by the chemicals with glass holding it in place was not satisfactory. The condensation occurred on the negative and fell back onto the fabric. This caused blotching of the print.

It was decided to allow the chemicals to dry on the fabric. The

Plate #2

Fabric Blueprint #1

sensitized fabric was either wrapped in newspaper or left in the darkroom so ultraviolet light would not reach it before exposure. This solved the problem of condensation whether an object and glass or a negative and glass were used during the exposure.

Different exposure times resulted in different values of blue. A short exposure time resulted in light blues; a long exposure time resulted in dark blues. A bright sunny day allowed the prints to become very dark; a cloudy day resulted in very light prints. When the prints were overexposed, purples and grays were often achieved in the areas supposed to be completely white. (Plate #3) Various colors of cotton fabric were used in the experiments. Blueprinting on yellow fabric produced a design with a green background and yellow images. (Plate #4) Pink material resulted in a print with a purple background and pink images. (Plate #5)

Delicately detailed objects resulted in more interesting prints than large leaves and solid objects. Other delicate objects used to produce images were a crocheted doily and the backing on pin striping tape. (Plates #6 and #7) Many of the prints were embellished with embroidery and trapunto. Some areas needed to be brought into sharper focus by the application of stitchery. White and blue embroidery floss was used on many prints and later it was discovered that many other colors also enhanced the prints. Some areas were left untouched and out of focus to create depth in the prints.

Plate #3, Fabric Blueprint #2

Plate #4, Fabric Blueprint #3

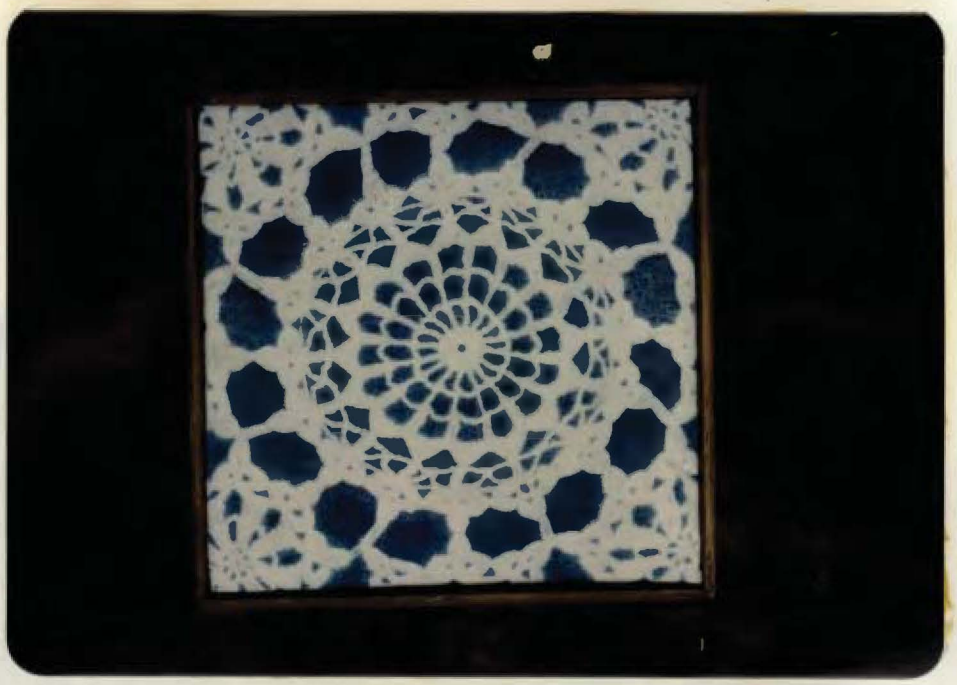

Plate #5, Fabric Blueprint #4

Plate #6, Fabric Blueprint #5

Plate #7

Fabric Blueprint #6

EXPERIMENTS ON WARP

After working several months with blueprinting on fabric, the application of the blueprinting process to a warp for weaving was considered. There were several problems that needed to be solved: 1) how to sensitize the warp, 2) how to stretch it out for exposure, 3) deciding what objects or images to use to form the design, 4) how to get the warp out into the sun or under an ultraviolet light source, 5) how to rinse the exposed warp, 6) how to get it from the printing stage onto the loom and 7) how to weave the printed warp.

Experiment #1 - Four Harness Loom

The first yarn used for a warp was 100% cotton rug warp. It was prepared on a warping board with a sett of fifteen ends per inch. Lease sticks were inserted at the cross and a string was tied from one end of each lease stick to the opposite end so they could not slip out. The warp and lease sticks were placed on a wooden bench covered with plastic. Nails were hammered in just in front of the first lease stick near the end of the bench to hold it in place. At the other end of the bench, a fifteen dent reed was placed with nails on either side of it to hold it upright. The warp was pulled to straighten it, the ends were cut opposite the cross and the reed was sleyed. The warp was pulled once again to straighten it.

The chemicals were applied to the warp with a brush. Foliage and weeds (the same type used on the fabric) were placed on the sensitized warp. The rather cumbersome bench was carried outside and exposed in bright sunlight for approximately twenty minutes. Rinsing the warp with the garden hose was attempted, but it needed to be immersed in water to get the undeveloped chemicals out completely. It was carried back

indoors. The warp was taken out of the reed and off of the bench and rinsed in the bathtub. After the warp dried, the loom was dressed in the usual manner for chain warping. There was a lot of twisting and pulling of the threads as they were untangled.

The warp was woven in crosswise rib and basketweave and areas of leno with white cotton weft. The blueprint design areas did not show up at all. (Plate #8) It seemed that applying the chemicals to the warp with a brush was not satisfactory. The warp did not accept the chemicals readily and they could not be applied equally with a brush. Some areas of the warp completely absorbed the chemicals and some areas were not covered at all. Many areas that were covered by the chemicals and exposed rinsed out. Obviously, the warp needed a longer exposure time in order to develop completely. The pattern areas could not be detected because of these problems.

The warp needed to be finer in order to absorb the chemicals completely. The sett needed to be more dense in order to allow the design to be picked up. The warp needed to be soaked in the blueprinting chemicals before sleying it through the reed and stretching it out. Finally, something was needed to hold the warp threads taut and under equal tension during the exposure so the design would not be lost as the ends were pulled tight during the dressing of the loom.

Plate #8

Experiment #1

Experiment #2 - Frame Loom

The yarn used for the next warp was No. 10 white Knit-Cro-Sheen 100% cotton. It was thinner than the rug warp used previously. The problem of holding the threads under tension during the exposure was solved by using a frame loom. The warp was wound onto a swift so the skeins of yarn could be soaked in the chemicals.

The frame was built from canvas stretchers. Three rows of nails were placed on each end of the frame, but only two rows could be used because the nails were so close together in each row. After the chemicals dried on the skeins of yarn, they were warped onto the frame loom. The sett was twenty ends per inch. Bold free-form shapes were cut from cardboard and placed on the warp. Glass was used to hold them in place. The frame was carried outside and exposed to the sun for two hours. The warp threads definitely needed much more time for development than did the fabric. It was difficult to detect change in color when the warp was used dry. The color change was not so dramatic as it was when working with fabric dampened by the chemicals or warp dampened by the chemicals. The design areas could clearly be seen after the warped frame had been placed in the bathtub and rinsed. The background was dark blue and the design areas were white.

A stick was inserted to create one shed for tabby and string heddles were attached for the other shed. It would have been impossible to pick up each row with a tapestry needle because the warp was so dense. Blue weft was used to weave the background areas and green weft for the white design areas. The wefts were joined with the tapestry technique of interlocking. Soumak and rya knots were added for interest and texture. Inexperience in using a frame loom was responsible

for the design being printed too closely to the top of the frame. A part of the design was not woven because it had to be used to tie the weaving to the dowel rod. (Plate #9)

The piece seemed to be a success visually. The green areas worked well with the blue areas caused by the chemicals. The chemicals caused streaking on the warp. This was especially evident in the design areas. It resulted in very subtle color changes in the design areas. (Plate #10) Actually, the blueprinting process may not have been necessary to achieve this weaving. A warp of all one color woven with blue and green interlocking weft yarns may have achieved very similar results. The interlocking technique resulted in some very angular edges on the design areas that were supposed to be very smooth and curved. It seemed the blueprinted warp would be most effective if most of the piece was woven in one color. This would allow the design areas to take their place as the prominent feature in this weaving. Additional color could be added as it was done in this weaving with soumak and rya knots. (Plate #11)

Plate #9

Experiment #2, detail

Plate #10

Experiment #2, detail

Plate #11

Experiment #2

Experiment #3 - Frame Loom

The frame loom was again used for the next project. Foliage and weeds were used once again to produce the design. It was believed they might work now that a successful way to apply the chemicals had been found and a denser warp would be used to pick up more of the design. Since a frame loom was being used, there would be less manipulation of the ends and less chance for distortion of the design. The same process of applying and exposing the blueprinting chemicals was used as on the first frame loom (Experiment #2).

Much of the design could not be seen after the warp had been rinsed and let dry. It was woven entirely with blue weft in tabby weave and in the same manner as the first frame loom project, using the sticks and string heddles to form the sheds. It was hoped that the use of only one weft color would help to accentuate the white design areas. After weaving, much of the design could still not be seen. There were some very subtle color changes that were very beautiful, but the delicate materials just could not leave much of an image on the warp. (Plate #12)

Plate #12

Experiment #3

Experiment #4 - Frame Loom

Since the delicate foliage did not leave a design, the objects or shapes had to be much bolder. The use of natural materials for the image was desired, so fallen leaves were collected from trees. They were much larger and less delicate than the materials used before, but they still had very interesting shapes.

Once again white Knit-Cro-Sheen was prepared and warped on the frame loom. It was exposed using the leaves to form the image. The leaf images showed up well on the warp. It was woven with blue weft in tabby weave.

The leaf shapes showed up quite well after the piece was woven. Once again there were subtle little color changes. The piece gave me the impression of falling leaves. It was quite successful as far as producing an acceptable image on the warp. The large leaves produced a much better image than did the small delicate foliage used in Experiment #3. They laid more flatly against the warp threads and did not have a tendency to fall through the threads. The leaves covered more area on the warp, so the sun was not so likely to find its way in underneath them. The leaves left larger images on the warp without losing their somewhat delicate character on the blueprint. (Plate #13)

Plate #13

Experiment #4

Experiment #5 - Four Harness Loom

Finding a way to blueprint a warp for weaving on a four harness loom was desired. The frame loom worked well, but was limiting in size. It also took a prohibitive amount of time to set up the string heddles for weaving.

Once again white Knit-Cro-Sheen was used for the warp. A denser sett of thirty ends per inch was used. The yarn was put into skeins, soaked in the chemicals, let dry and prepared on the warping board. The very minimum for loom allowance and take up was allowed because the more length dealt with the more easily threads might become twisted and tangled. This allowance would vary from loom to loom.

A large warping board was used as the base for the warp. The reed was tied to one end of the board. Lease sticks were inserted at the cross. The first lease stick was tied to the end of the warping board opposite the reed. After cutting the ends opposite the cross, the fifteen dent reed was double-sleyed with the warp. The ends were tied into one-inch knots behind the reed to hold the tension. It was carried to a table by a window where no shadows would fall across it and sunlight would hit it directly. The warp was kept under black plastic as the threads were straightened and bold geometric cardboard shapes were placed on it. It was exposed for one hour and forty-five minutes. Once again, problems with tension caused some threads to fall out of place.

After the warp was exposed, the reed and lease sticks were untied from the warping board. The lease sticks were tied from end to end so they could not slip out. It was rinsed in a sink, partially immersed, and partially sprayed with a hose. The reed was left on to hold the ends in place, but it was not immersed.

Once it was dry, the short lease sticks were replaced with the ones from the loom. They were then tied to the loom. The warp was laced to the warp beam in the usual manner. The untied end of the warp was held taut as the reed was slid back and forth to straighten the threads. The warp was wound onto the warp beam and taken out of the reed. The dressing of the loom was completed in the usual manner.

The warp was woven with a very fine creamy colored weft in herringbone twill. The twill added some surface interest increased by the subtle color changes caused by the blueprinting chemicals. The weave was varied by doubling and tripling the weft in various areas. This variation was not readily seen unless the weaving was studied closely. The image of the cardboard shapes showed up well. There were areas where the image was slightly distorted because of the problems with tension during the exposure. Once the warp was pulled and placed under tension on the loom, it became evident that the same tension was needed during the exposure. In this weaving, the distortion was not distracting. The way the images moved out of the rigid geometric shapes as the background moved into them was pleasing. However, this would not be suitable for all designs. (Plates #14 and #15)

Plate #14

Experiment #5

Plate #15

Experiment #5, detail

Experiment #6 - Four Harness Loom

After a thaw that caused the snow to melt during the winter, a blueprinted piece of fabric was found that had accidentally been left on the porch. The wind had blown it and had folded it in many different places. Each different fold resulted in a slightly different color area. (Plate #16) Treating a warp in a similar way was considered.

Yellow Knit-Cro-Sheen was used at thirty ends per inch for the warp. It was sensitized with the chemicals as before, but was not threaded through a reed. There was no concern with keeping the threads straight or evenly spaced. The warp was tied into large knots and exposed so that areas in the knots would not be exposed, and areas just coming out of the knots in partial shadow would be exposed differently than the threads in full sunlight. It was hung up in a window for one hour and thirty minutes. The warp was taken down, the knots untied and then the warp was rinsed. The loom was dressed in the usual manner for chain warping.

This was not a successful attempt. There were no definite shapes or areas at all. Fine yellow weft and dark green weft were woven in to try to accentuate certain areas with one color or the other. It was woven in warp-faced twill to allow the blueprinted warp to show as much as possible. The clasped weft technique was used: the weft threads came toward each other, interlocked and traveled back to the selvedges all in the same shed. The wefts could then be pulled one way or the other to place the colors and connections in the desired area. Pulled up loops were used to bring out certain areas and add texture. After the piece was taken off the loom, additional areas of pulled up loops were woven in. This was done to create depth in the weaving. The line

Plate #16

Folded Fabric

of green pulled up loops seemed to wind its way underneath the areas of yellow and then reappear. The piece was unsuccessful because there was no definite blueprinted design on the warp. There was no definite design to follow as the weaving progressed as there was in the previous weavings. Therefore, it was woven somewhat haphazardly. (Plates #17 and #18)

Plate #17

Experiment #6

Plate #18

Experiment #6, detail

Experiment #7 - Frame Loom

A cream colored cotton yarn was used for the warp and was prepared as for the other frame loom weavings. Bold zig-zag shapes of cardboard were placed on the warp for the design. After the warp was exposed, it was noticed that the image was not so evident as it was on some of the previous warps. Perhaps the cream color of the warp did not contrast enough with the blue of the background. Purple, lavender and blue weft stripes were woven into the warp and rya knots were added to enhance the shape of the design.

The various colors of weft stripe seemed to add some interest to the background. This was needed since the blueprinted image was not very strong. Some of the rya knots of blue, purple and lavender novelty yarn were added during the weaving. After the piece was taken off the frame loom, more rya knots were added to make the zig-zag design more pronounced. The rya knots were gradually added in greater amounts as they were worked in starting from the top to the bottom. They formed a fringe at the bottom as they covered the distracting warp ends which, when cut, exposed the cream colored core of the blueprinted ends. (Plate #19)

Plate #19

Experiment #7

Experiment #8 - Frame Loom

Exposing the warp to an ultraviolet light source other than the sun was attempted. The sun often did not cooperate when the materials were ready to be placed in the sun for exposure. A small shortwave ultaviolet light was obtained.

The frame loom was prepared as before, this time using lavender Lily mercerized cotton 20/2 yarn. Small areas of the warp were wrapped with heavy rug yarn. The warp was exposed with the ultraviolet light about two feet away. A small change in the color of the warp was noticed after several hours under the lamp, but it was realized that the lamp was not strong enough. The exposure was completed by putting the warp in the sun.

After the wrapping was cut off and the warp was rinsed, it was decided that the areas wrapped were not large enough and not enough areas were wrapped. The design was very weak because of this. The piece was woven with blue and lavender weft in tabby and leno weaves.

The design seemed to form a plant-like image with the base of the plant being the large area of lavender at the bottom of the weaving. The smaller branch-like lines of lavender radiated out from the base. The areas of leno formed pod or leaf shapes, especially the areas woven with blue weft. (Plate #20)

Plate #20

Experiment #8

Experiment #9 - Frame Loom

Once again the lavender warp was wrapped to create the design. A frame loom was warped at a sett of thirty-four ends per inch. This time more and larger areas were wrapped. The warp was exposed with a larger long wave ultraviolet light placed about two feet from the warp. After three hours of exposure, a corner of the warp was tested by rinsing it with water. Considerable development had taken place, but it was not so dark as desired. The exposure of this piece was also completed in the sun.

The wrapping was cut off and the warp was rinsed. The shapes were very rectangular and bold. This was caused by the wrapping of larger warp bundles. This piece was woven in tabby with blue and lavender wefts to bring out the geometric shapes and add variety to their colors. The irregular rectangular shapes were formed by wrapping an area with the rug yarn for a few inches and then leaving part of the ends out of the wrapping. Some of the irregularity was also caused by slight pulling of the ends. (Plate #21)

A return was made to working with blueprinting chemicals on fabric just to see if the ultraviolet light would work on it. The chemicals were applied and the sensitized fabric was exposed while damp. The ultraviolet light was placed ten inches away. An object was placed on the fabric and exposed for twenty minutes. It did develop, but was not so dark blue as desired. Another piece of fabric was exposed for twenty-five minutes and another for thirty minutes. They all seemed to be about the same shade of blue. Apparently, this type of ultraviolet light would develop the chemicals only to a certain shade of blue.

It is not known why the light would not work more quickly on the

Plate #21

Experiment #9

chemicals on the warp. One reason may be that the light had to be placed farther away from the warp in order to achieve even lighting on the entire piece because it was much larger than the small pieces of fabric. It was known that the warp would take longer to develop than the fabric because it took longer under the sun. A stronger light with a reflecting device that would throw the rays out more strongly would be helpful.

While working with the fabric and chemicals, the negatives that had been used to create an image on the fabric were considered. More negatives were desired, but the facilities were not available. It was decided to try drawing on acetate with ink. The ink was allowed to dry. The acetate and ink "negative" was placed on the sensitized fabric and exposed. It worked well. The completely opaque ink areas left a bold white area on the fabric. The ink areas that were somewhat transparent developed into various shades of blue. (Plate #22)

Plate #22

Ink Blot on Acetate and Blueprint

Experiment #10 - Four Harness Loom

Acetate "negatives" were used for the next weaving. Plastic was purchased by the yard so larger designs could be used. It was cut to size and pod-like shapes were painted on the plastic with black acrylic paint. The acrylic paint was used so the design areas would be opaque and would result in a bolder image on the warp. (Plate #23)

The problem of uneven tension during the exposure was solved by using a wooden base with boards to clamp the warp under at either end. (Plate #24) No. 30 white cotton Knit-Cro-Sheen was prepared as before: wound onto a swift into skeins, soaked in the chemicals, hung up to dry and prepared on the warping board. (Plates #25 - #28) Two skeins of yarn dried differently from the rest. This is evident in the plates. It is not known why this occurred. It may be they were at the lower end of the hanger during drying and absorbed chemicals from the other skeins. It did not seem to affect the final color of the warp after exposure. A denser sett of forty-five ends per inch was used because the warp was thinner than the No. 10 used previously.

The lease sticks were inserted at the cross and the warp was placed on the wooden base. The end of the warp nearest the cross was clamped under the board at the end of the base behind the lease sticks. A spreader was inserted to divide the warp into inches which could be worked with more easily. (Plate #29) The reed was clamped upright to the other end of the base board. The ends opposite the cross were cut and sleyed, three threads through each dent of the fifteen dent reed. (Plate #30) The warp at the end clamped under the board was loosened and the lease sticks were allowed to drop over the edge taking with them enough warp for the loom allowance at the back of the loom. The

Plate #23, Experiment #10, painted plastic

Plate #24, Wooden Base

Plate #25

Skeins & Swift

Plate #26

Skeins in Chemicals

Plate #27, Skeins Drying

Plate #28, Preparation on Warping Board

Plate #29, Spreader Inserted in Warp

Plate #30, Warp in Reed

warp was once again clamped under the board and left quite loose. The other end of the warp was clamped under a board after it passed through the reed. It was tied into knots in one inch sections after it came from under the board to ensure the warp would not slip. The reed was combed back and forth along the warp, spreading it out at the end nearest the cross. This end was clamped very tightly. The reed then was moved back to the end opposite the cross and clamped in its original place. (Plate #31)

The plastic with dry paint was placed on the warp and carried outside. The plastic was taped at the edges away from the warp to hold it in place. It was exposed in the sun for one hour and thirty minutes. (Plate #32) The warp was unclamped leaving the reed and lease sticks on the warp and it was rinsed in the bathtub. The reed was not immersed in order to keep it as dry as possible.

The lease sticks were tied to the loom and the warp was laced to the warp beam. The reed was placed into the beater and was used to straighten the threads as they were wound. After the warp was beamed, the reed was removed. The loom was then dressed in the usual manner.

The tape used to hold the plastic in place did not hold it securely. The design areas did receive some light toward the end of the exposure. This, along with some staining of the threads, caused areas that were to be white to become light blue.

The piece was woven with blue weft in tabby weave. Pulled up loops of the blue weft and pulled up loops of laid in light blue novelty yarn were added to introduce more color and texture. The pulled up loops were placed in areas to look as though they were spilling out of the pod shapes. Some pod shapes did not have loops added in order to give the

Plate #31, Warp Prepared for Printing

Plate #32, Warp in Sun

eye a resting place and to create the illusion of depth. That is, some of the pod shapes seemed to be in front of others because the details were seen.

This piece was very successful in that the blueprinted images showed up quite well. There seemed to be an upward movement of the forms almost like blue flames of fire. The piece was finished with screen molding glued across the top and the bottom to cover the unattractive cut warp ends. (Plates #33 and #34)

Plate #33

Experiment #10

Plate #34

Experiment #10, detail

Experiment #11 - Four Harness Loom

For this weaving, a plant design was applied to the plastic with black acrylic paint and a brush. (Plate #35) The same procedure was followed as with the previous weaving using the base board and clamps to keep the threads taut. The warp was exposed for one hour and forty-five minutes.

Mint green Knit-Cro-Sheen was used for the warp. After the exposure and rinse, it was noticed the warp was a greenish blue color, a color very different from those achieved in the other weavings. This warp was woven with blue weft in tabby weave and pulled up loops following the design areas. Areas of the original color, mint green, were laid in and pulled up in loops.

After the piece was finished, it was evident that the pulled up loops of mint green were too bright. The areas of the design in the warp were not the original bright color. They had been stained slightly by the chemicals and were woven with blue weft which dulled them even more. It was decided to add areas of pulled up loops in a muted mint green. Some of the thread used for warp was soaked in blueprinting chemicals and exposed for about twenty minutes. The undeveloped chemicals were washed out. The thread was partially developed in some areas and was stained in others. It was worked into the weaving as pulled up loops near the areas of bright mint green pulled up loops. This seemed to subdue those areas somewhat. (Plate #36)

Plate #35

Experiment #11, painted plastic

Plate #36

Experiment #11

Experiment #12 - Four Harness Loom

Plastic with a design applied to it was used for this project also. Ink was dropped onto the plastic and scribbled over the surface. (Plate #37) Two strips of plastic were treated this way so two different sections of warp could be blueprinted. The warp was melon colored Knit-Cro-Sheen.

The same procedure was followed as in the two previous experiments, using the base board and clamps to keep the threads taut. The warp was exposed for one hour and thirty minutes. Both sections of warp were treated this way.

The two sections were woven as panels divided by solid areas of blue. Three sections of dark blue warp were prepared on the warping board. These were placed in the correct order on the lease sticks with the blueprinted sections. The lease sticks were tied to the loom. All of the warp was placed in the spreader and was tied to the warp beam. Only one fifteen dent reed was available during the exposure, so it was taken off the first blueprinted warp to use during the exposure of the second warp section. The reed was left on the second warp section during the winding onto the warp beam to straighten and untangle threads. After the warp was beamed, the reed was removed.

The heddles were threaded. An unevenly spaced warp was planned. The blueprinted areas were sleyed as they had been during the exposure--thirty ends per inch. The solid blue areas were sleyed at various setts, skipping some dents and double-sleying others.

The weaving was started with several colors of blue and melon weft. The melon color did not work. It seemed to blend all the areas so that

Plate #37

Experiment #12, inked plastic

the design areas did not show up. Instead, the entire piece was woven in blue weft with tabby weave. Leno was woven in a free-form design in some of the solid blue sections to add interest and repeat the design in the blueprinted sections.

The two blueprinted sections had slightly different colors because they were exposed at two different times of the day under slightly different weather conditions. The blueprinted sections may have been more effective if more of the ink areas had been completely opaque. Because the ink areas were somewhat transparent, the blueprinted image was very light in some areas. The black acrylic paint worked better as used in Experiments #10 and #11. However, the acrylic paint would not have been so easy to drop onto the plastic to get interesting shapes.

The division of the piece with the blue section was quite effective. The two panels would not be nearly so interesting if they were hung by themselves without the solid blue sections. The transparent areas of ink on the plastic did result in some very subtle, interesting design areas. (Plates #38 and #39)

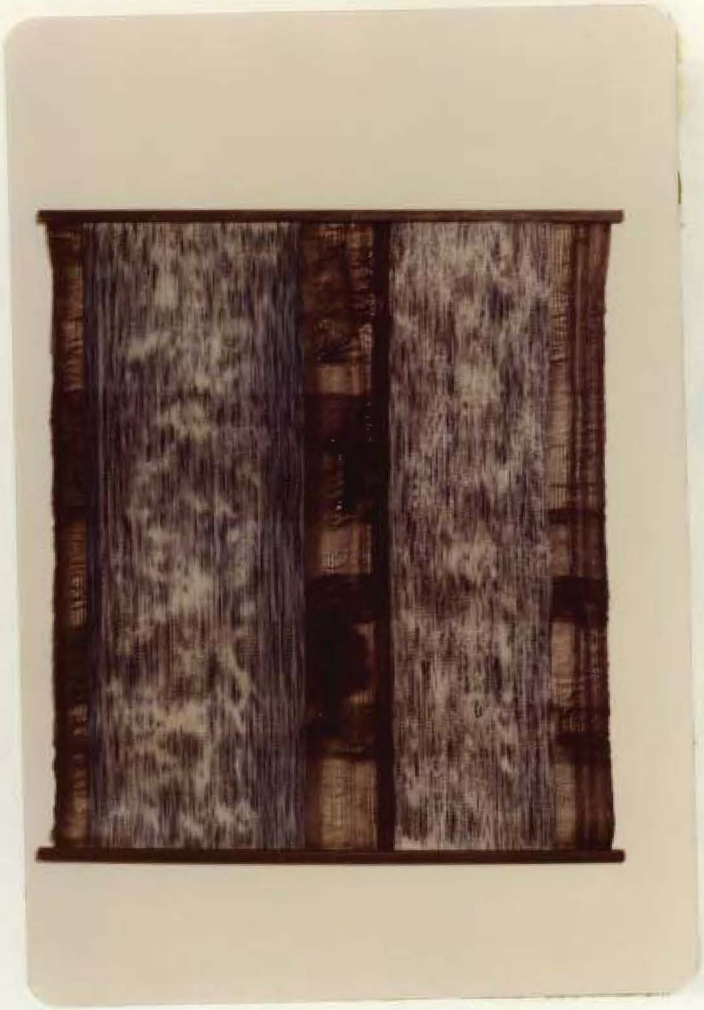

Plate #38

Experiment #12

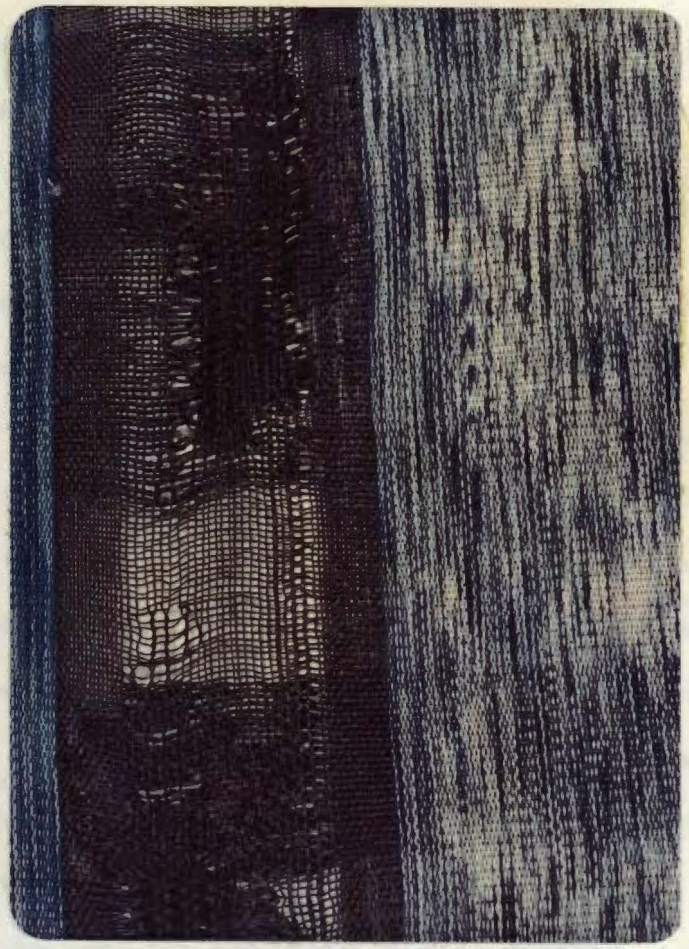

Plate #39

Experiment #12, detail

CONCLUSION

The processes and projects included in the proceeding pages were completely experimental. They are not presented as finished works. The pieces near the end of the research reached near finished quality. The concern was to experiment with the blueprinting chemicals: find ways of using them on warps, find ways of producing designs, find ways of weaving warps. It is hoped that this paper will stir a bit of interest in this almost unexplored area of warp application.

Successful ways were found to apply the chemicals to the warp, place it under tension, expose it and rinse it. Weft color choices were limited. It had to be remembered that the design elements were in the warp. Elements, color or technique, could not be used that might overpower the design. This would have been easy to do because the design was often subtle and delicate even when started with bold shapes.

The design possibilities have not been exhausted for blueprinted warps. They have just begun to be explored. The basic knowledge needed to blueprint a warp is now known. It seems the design possibilities are limited only to one's imagination.

Only cotton was used for the warps in this research. It will be interesting to try other natural fibers such as silk. It may also be possible to use man-made fibers and blends such as cotton-polyester. Another possibility might be applying the woven blueprinted warp to another weaving.

There are other non-silver photographic processes which could be explored for application to a warp. One of these processes is brown-printing which results in brown images instead of blue and would open up another area of color possibilities.

GLOSSARY

BASKETWEAVE--A weave in which two weft shots travel over and under sets of two warp threads.

BEAMING--The process of winding the warp onto the warp beam.

CONTACT PRINTING--The process of placing a negative in direct contact with a sensitized surface for exposure.

CROSS--Criss-crossing of warp threads to keep them in order during warping.

CROSSWISE RIB--A weave in which two weft shots of filling are in each tabby shed.

DENT--The space in the reed of the loom.

DRESSING--The preparation of the loom for weaving, which includes: beaming, threading the heddles, sleying the reed and tying into the cloth beam.

END--An individual thread in the warp.

HEDDLE--In the loom, one of a set of cords, wires or strips of metal suspended from a harness with heddle eyes through which warp ends are threaded.

HERRINGBONE TWILL--A derivative of the twill weave.

LAID-IN--A finger weave in which decorative weft yarns are added to a plain-weave ground in selected portions of the web.

LEASE STICKS--Rods that keep alternating warp threads in order during warping and on loom.

LENO--Open weave made by twisting warp threads around each other.

LOOM ALLOWANCE--The additional length added to the warp to allow for tying and waste.

REED--Removable part of the beater which spreads the warp.

RYA KNOT--A Scandinavian pile weave based on the Ghiordas Knot.

SETT--The number of warp threads used per inch.

SELVEDGE--In a woven cloth, the warpwise edges at which the weft wraps around the outermost warps as it reenters the web. The selvedges prevent unraveling.

SHED--Opening in warp through which shuttle passes.

SLEY--To put a warp thread through a dent of the reed.

SOUMAK--A technique of wrapping wefts around two or more warp ends to produce a surface similar to chain stitch.

SPREADER--A flat stick with nails or spikes protruding at one-inch intervals; used to distribute the warp yarns evenly on the loom.

SWIFT--A device used to hold a skein of yarn while it is wound onto spools or shuttles, or to wind a skein from a cone or spool.

TABBY--Plain weave. A basic weave created by consistently interlacing one warp yarn with one weft yarn.

TAKE UP--The extra yarn allowance needed for lacing over and under the opposing set of yarns in weaving.

TRAPUNTO--A type of quilting in which shapes are raised from the background with a filler material.

WARP--Threads stretched lengthwise on the loom.

WARP-FACE--A weave in which the warp yarn predominates or covers the weft completely.

WARP BEAM--Roller in back of a loom on which the warp is wound.

WARPING BOARD--A pegged rectangular or square board for making warps of short lengths.

WEFT--Threads crossing the width of the fabric.

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SUPPLIERS

Cerulean Blue, Ltd.
1314 N.E. 43rd Street
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3763 Durango Avenue
Los Angeles, California 90034