PHOTOFABRICATION METHODS FOR THE PRODUCTION
OF CERAMIC DECALS

A Thesis
Presented in Partial Fulfillment of the Requirements
for the Degree Master of Fine Arts

by
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Advisor
Division of Art
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ACKNOWLEDGEMENT

My special thanks to Hoyt L. Sherman for his always uplifting advice. I would also like to thank Eugene Friley for his time and effort. And, most of all, my utmost gratitude to Stephen, Challen, and our farm friends in Logan, Ohio, who made this work possible.
INTRODUCTION

The information in this paper is the result of two years of work in the graduate program of the Division of Art of The Ohio State University. Throughout this period there was a continuing interest in incorporating two-dimensional imagery with three-dimensional form.

Several approaches were tried, and while some methods proved satisfying, the possibilities of the use of photographic imagery appealed to me most. A technical reflection of the real world, the photograph demands credibility for those of our western culture. Yet, because of its two-dimensional surface it must remain illusion.

The use of the photographic image also appealed to me because of the various kinds and demands of the processes involved. Over the past few years I have become increasingly aware of my involvement with process. Since the forms I have been constructing appear to have Pop and Funk derivations, I draw sustenance from reading of artists aligned with these movements who shared an involvement in process. Of Roy Lichtenstein: "his overstated Benday (sic.) screen dots play a conspicuously formal role, and he compels our attention to medium and process,"¹ and "the Ben Day dots are to the painting of Lichtenstein what the brushstroke is to Abstract Expressionism, an image of process."² Sam Hunter says of Jasper Johns, "his structures
elucidated the creative process itself...breaking down and reconstituting elements of illusion and literal fact."³

Such statements further encouraged my method of working and helped me to become more aware that the evidences of process can be an important aspect of composing. Thus, pieces are left with mold marks, forming cracks, fingerprints. Most of the photographs used were screened, then enlarged to such a degree as to make dot patterns obvious. This overstatement serves further to document process.

Most of the pieces constructed to receive photographic images were derivations of the paraboloid form. For my own purposes I choose to think of them as monuments—in concept as well as in form. They are monuments because their shape resembles tombstones or steles. They are monuments because they represent my attempts to bring together the separate pieces of my life into a single expression.

Working in clay is a release from everyday life for some persons, but for me clay is the ideal medium to serve as a record of the rest of my world.

The basic paraboloid shape must have some subconscious significance to me, as it continues to appear in my work. Perhaps it is a reflection of the hills in the countryside I love.

Using toys as forming aids adds to the pleasures of throwing and handbuilding. Were it not for my daughter I
might not have seen the possibilities of such toys (animal molds, letter stamps, play-doh extruder). Because I am aware of her childhood, I remember my own more clearly and choose to use stories, songs that appealed to me at that age.

Many of the pieces contain references to chickens: the chicken carcass, the egg mold, photographic images, stamped letters. To me the chicken is a natural subject: poultry carcasses fascinated me as a child, probably because they retained some of their animal identity. When I made the chicken mold a year ago, the anthropomorphic qualities of the carcass impressed me. Several months ago I became the keeper of nine Leghorns; they have almost become pets. Thus, the subject and form are natural to my work.

The pieces, therefore, are about what I like to do with clay, forms that appeal to me, subjects that are about part of my life. The resultant works, however, are not intended to make a statement about chickens or chicken products. Rather, they are most of all problems in achieving visual unity.
PHOTOGRAPHIC PROCESSES

The method chosen to combine photographic imagery with ceramic form utilized the decal process. The ceramic decal offers several advantages: being ceramic, as the name implies, it may be as permanent as the piece itself—the ceramic pigment that forms the image bonds with the ceramic form during firing; furthermore, the decal can conform to the contours of the piece (within certain limitations) without distortion of image.

With limited darkroom equipment the ceramist can make decals from his own photographs. This is very satisfying to me and seems much more personal than thumbing through magazines and newspapers for materials to use in the acrylic lift process (see Addenda).

Some knowledge of photography is helpful. By understanding what is happening, one may have more control over the process. Knowing how a camera works, how to develop and print your own photographs is essential. Some reading in elementary photographic chemistry is also advisable. Kodak publishes an excellent two-part workbook series on photographic chemistry that is geared toward self-learning. I would also recommend a few of the Kodak publications on photography for the graphic arts. They explain in greater detail the processes discussed here, as well as some processes not dealt with in this paper.
To obtain an image for use in the decalcomania process, one must convert a continuous tone photograph (Figure 1) to black and white, or line copy. Three methods of making this conversion are line shot, posterization, and halftone. The black and white image may then be transferred to a silk screen and printed on decal paper.

The process of converting continuous tone photographs to line copy is most often associated with the graphic arts industry, and involves a great deal of sophisticated equipment. One may have images processed at such a company, but the expense for any amount of work is often prohibitive.

Many schools have graphic arts equipment available—process camera (or copy camera), vacuum frame, carbon arc lights. I had the advantage of access to such equipment before I realized I could duplicate many of the results I was obtaining in my own darkroom. The ceramist with access to darkroom equipment can process continuous tone copy at a nominal cost. My greatest expense after purchasing an efficient timer was for film. Other equipment and materials may be assembled very inexpensively.

Three basic processes of converting continuous tone copy for production of decals are discussed in this paper: line shot, posterization, and halftone. Additional and more complicated methods are available to the ceramist and are discussed in the Kodak booklet Special Effects for Photomechanical Reproduction. It must be noted that the
FIGURE 1

Continuous Tone Photograph
Kodak Graphic Arts series is geared to persons with access to more complicated equipment, such as a process camera. However, the basic information is there and should quite easily be converted to home darkroom use.

The processes discussed make use of special high contrast films. These lithographic films, known by several trade names (Kodalith, Ilford's Formolith), are usually very slow in their reaction to light, and are often orthochromatic (insensitive to red light). They must be developed in a special developer, and each brand film recommends its own brand developer. Quite often the developer is purchased as a two-part solution and a little is mixed just before use. Standard stop, fix, and clearing solutions may be used.

There are many variables to deal with in transferring continuous tone copy to line copy: exposure time, degree of enlargement, amount and source of light, development time, developer temperature, and amount of agitation. If as many variables as possible are held constant, usable results will be obtained more quickly. For all methods discussed in this paper, developer was mixed per instructions at 68°F, and a standard development time of two minutes, 15 seconds was adhered to. It is helpful to keep records of each session, listing exposure time, size of enlargement, any difficulties encountered--at least in the beginning. Such notes can serve as a handy reference later
and save a lot of time.

The production of photographic silk screen decals may use many processes, including the following three, but all must result in a positive transparency.

Line Shot

First and easiest of the three methods is the line shot. Place the negative image in the carrier of the enlarger, focus and expose on Kodalith, Formolith, or comparable film. Gray tones in the negative will be translated to either black or white. Exposure time will determine which gray areas go black or hold as white. The effect may resemble a pen and ink drawing yet keep its identity as a photographic image (Figure 2).

Posterization

The posterization process involves two or more exposures and the use of a patterned piece of acetate called a flat, tint, or Ben Day screen. The screen is ruled with a certain number of lines or marks per inch (i.e.: 65 line, 50 line). The degree of darkness of a tint screen is rated in percentages from 0-100%. Ten percent would be an almost black, while 100% would be clear.

Keep in mind the mesh of the silk screen to be used when considering which Ben Day screen to use. For ceramic
work, 100 line would probably be too fine. I used patterns ranging from 40 to 65 lines. Percentages of darkness were from 30% to 60%.

Some device for keeping the Ben Day screen flat against the lith film is essential in making a posterization. A contact printing frame should work well, but I used a heavy piece of glass with no difficulty.

Place the negative in the carrier, focus, then tape the film on the enlarger board, emulsion side up. Place the glass on the film and make a standard line exposure. Remove the glass, place the Ben Day screen over the film, replace the glass and make a second exposure 2-1/2 times the length of the first.

The resulting image should have black, white, and one shade of "gray" that is the pattern of the Ben Day screen (Figure 3). Posterizations may be made with two and even three shades of "gray" by using two or more different screens and making additional exposures. However, care must be made to angle the screens to avoid getting a moire pattern.7

Halftone

The halftone image normally involves the use of a halftone contact screen. This is a piece of film covered with dots in much the same way as a Ben Day screen. They
differ from Ben Day screens in that the dots are three-dimensionally conical and have the ability to interpret the amount of light passing through them. Thus the halftone image is composed of varying-sized dots which may, from a distance, simulate the gray tones in a continuous tone photograph.

Correct exposure for line shots and posterizations can be determined by eye, but a printer's gray scale is almost indispensible in shooting halftones. A gray scale is a strip of developed film or paper with varying degrees of gray from white to black printed in numbered steps. The scale is placed to the edge of the copy or film and exposed at the same time. The numbered steps serve as a reference in exposure control.

To shoot a halftone using a contact screen, focus the image, place film emulsion side up, place a transparent gray scale near the edge of the film emulsion side down, and place the contact screen emulsion side down. Place the glass over all and make an exposure. When developed, the film should show a 50% dot between steps 5 and 7 on the gray scale. This ratio is easily recognized because of its checkerboard pattern.

Contact screens are quite expensive, but halftones may also be made by using Autoscreen film in place of standard lith film. This is a film with a built-in dot pattern, and when exposed will result in a halftone image. Exposure
procedures are the same as for making a line shot. (Figure 4 shows halftone made from Autoscreen film.)

Since the dot pattern on contact screens and Autoscreen film commonly ranges from 85 to 133 lines per inch, the halftone should be enlarged at least three times to print well through the silk screen fabric. If the halftone original is made fairly small, it can be trimmed to fit in a 35mm to 2-1/4 square negative carrier and easily enlarged. The enlarged image will be a negative transparency, so a contact print must be made to obtain the positive transparency required for silk screen printing.
FIGURE 4
Halftone
FABRICATION OF CERAMIC DECALS

Photographic decals are printed with a silk screen. For the ceramist, the screen must be of the largest mesh possible to allow the ceramic materials that constitute the printing ink to pass through without clogging. Nylon or polyester will hold up better than silk. Screens may be made or purchased at a commercial silk screen supply company. (See list of suppliers.)

Photo-sensitive silk screen film must be used to get an image on the screen. I obtained excellent results using Ulano Blue-Poly 2, though there are other types of film that should be just as suitable. Developer for these films should be purchased at the same time. The film manufacturer recommends a carbon arc lamp as the best light source for exposing the film, but any light which contains the blue spectrum (ultraviolet, black light, photoflood, even sunlight) will suffice. Use a small piece of film and a positive transparency and make an exposure test under your light source until proper exposure time is established. (The film may be handled safely in a dimly lit room—yellow "bug" lights are ideal.)

Getting Photographic Image on the Silk Screen

The silk screen should be cleaned with a good grease remover, such as Ajax or Comet, and dried shortly before
it is to receive the film. Cut a piece of photo-sensitive film slightly larger than your transparency and place it according to manufacturer's directions. Blue-Poly 2 must be placed with the backing (shiny) side up. Position the transparency emulsion side down on top of the film. Hold the two in contact with a piece of glass, and make an exposure. I exposed my film under a carbon arc lamp in a vacuum frame for 6 minutes at 40 inches. Exposures under bright sunlight may be at least 30 minutes.

Developer comes in a two-part packet and may be mixed while film is being exposed. Develop film according to directions, then rinse in several baths of warm water until the water remains clear. You should now have a photographic stencil that is a reverse image of the transparency used.

Place the silk screen film backing side down on several layers of clean newsprint on a level surface. Lower the silk screen carefully over the film until it makes contact. With more clean newsprint press on the silk screen fabric so that the emulsion is thoroughly embedded into the screen. Let the screen dry for at least two hours—even overnight—then slowly remove the backing sheet. If any emulsion has been torn away, touch up the holes with water soluble block-out or a dilute solution of LePage's glue. After printing, remove the stencil from the silk screen with warm water and a cleansing powder.
Printing the Image

After the backing sheet is removed, the image may be printed on decal paper. There are several kinds of decal paper, and I had best results using Simplex Super-flat decal paper.

The ink, or pigment used in printing was powdered commercial china paint or overglaze mixed with a commercial decal medium. I ground the dry pigment in a mortar and pestle, then mixed it with decal medium on a glass plate with a palette knife. The ink should be the consistency of thick cream. I found it very important not to have too thick an ink, as a heavy concentration of pigment will burn off during firing. Thus, not only must the ink be kept from containing too much pigment, but printing should be done with only one pass of the squeegee. It may help to print several trials on newsprint before using decal paper. Lacquer thinner will remove both the pigment and the following cover coat from the silk screen.

After the decals are printed, they should dry from four to twelve hours, though 24 hours is optimum. A fan will speed drying time. The image must then be fixed to the paper with some sort of cover coat. I tried several cover coats: acrylic spray, polymer, lacquer, but had best results using a commercial decal cover coat. I found it best, too, to use an old silk screen to apply the cover
coat. Using a screen instead of a brush or spray assures a uniform coat. Too much cover coat may cause burn-off problems.

Applying the Decal

All decals in the plates were applied and fired to glazed ware, but it is possible to apply decals composed of stains or glazes to unglazed surfaces and fire to the temperature appropriate for the pigment used.

To apply the decal to a ceramic piece, clean the area that is to receive the image with denatured alcohol and dry it. Cut out the decal just outside the image area and immerse it in room temperature or barely warm (not hot) water. The paper will begin to curl immediately, then will slowly uncurl. It is important to remove the decal as soon as it will release—probably just when the paper begins to relax and uncurl. If it is soaked too long, not enough starch or glue will remain to hold the image to the ware.

As soon as the decal releases, place it on the prepared ceramic piece. Some adjustment of the image is possible, but care must be taken not to move the decal around too much—it may tear, or too much glue will be lost to hold it sufficiently in place. It is important to work out all air bubbles as soon as the decal is in place. Any air bubbles left will burn off, resulting in a blank space in the image
area. I used damp paper toweling and worked from the center out, but one may use a small piece of cardboard or a small squeegee.

Firing Procedure

The piece should dry at least 24 hours before firing. (Use of a fan may accelerate drying time.) My decals were all fired to cone 019. Though the maturing temperature for most china paints is published as cone 013, this recommendation is to ensure a good bond for functional use. The lower firing temperature of 019 resulted in a sufficiently firm bond (image would not scratch) and gave fewer problems of blistering, crawling and burn-off. Since my pieces were not intended for utilitarian purposes, this temperature was entirely satisfactory.

The firing cycle should be fairly slow. In all cases my pieces were placed in an electric kiln that was vented and held below 200°F for two hours. The kiln was then allowed to climb slowly to the shut-off temperature. When temperature is past 1000°F the kiln may be closed for the remainder of the firing. When maximum temperature is reached, the kiln may be held at 1000°F for two hours, then let slowly cool. This insures optimum results.
CONCLUSION

Decalcomania is only one of several photographic processes available to the ceramic artist. It seemed the most intriguing to me because there is very little written information available on the subject. Having the ability to incorporate photographic images on a piece with control over the entire process greatly appeals to me. This means I can plan a piece in clay, take the photographs needed, process, print and fire them without being dependent on outside assistance. Knowledge of various darkroom techniques has proved helpful. Each of the three processes discussed results in an image with distinct characteristics. Depending on the ceramic piece, an image may be more suitable as a posterization instead of a halftone. By knowing these processes, I have more control, more flexibility in executing my work.
ADDENDA

Information about other photographic processes available to the ceramic artist may be found by reading "Photographic Applications to Ceramic Art," a Division of Art M.F.A. thesis by Clinton Evan Thornton, B.A. Ed., The Ohio State University, 1970. Victor Spinski is fairly well known for his work in photoceramics, and one might obtain information by writing him: Victor Spinski, Art Department, University of Delaware, Newark, Delaware 19711.
FOOTNOTES


4. *Basic Chemistry of Photographic Processing, parts 1 & 2*, Kodak Publication No. 2-23-ED.


6. It is possible to interchange brands, for I have developed Kodak film in Ilford developer, and Ilford film in Kodak developer.

7. *Halftone Methods for the Graphic Arts*, p. 18. A Moire pattern resembles the fabric of the same name and is considered objectionable by printers.

8. L. Reusch & Company, decal medium #312.

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<td>#1</td>
<td>&quot;Decker Memorial&quot; 39&quot; high. Clay body #2 thrown and salt-fired to cone 10. Sprayed engobe #1 and sprayed cobalt carbonate, china paint decal and silver luster.</td>
<td>25-26</td>
</tr>
<tr>
<td>#2</td>
<td>&quot;Tales Once Told&quot; 21&quot; high. Clay body #1 press-molded and hand-built, salt fired to cone 10. Sprayed with engobe #1 and cobalt carbonate. China paint decal, silver and mother-of-pearl lusters.</td>
<td>27-28</td>
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<tr>
<td>#3</td>
<td>&quot;Song from Childhood&quot; 20&quot; high. Clay body #1 press-molded and hand-built, salt fired to cone 10. Sprayed with engobe #1 and cobalt carbonate. China paint decal, silver and mother-of-pearl lusters.</td>
<td>29-30</td>
</tr>
<tr>
<td>#4</td>
<td>&quot;Finger Lickin...&quot; 19&quot; high. Clay body #1, press molded and hand-built, salt fired to cone 10. Sprayed with engobe #1 and cobalt carbonate. China paint decal and silver and mother-of-pearl luster. Feather.</td>
<td>31-32</td>
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<tr>
<td>#5</td>
<td>Covered Jars 6&quot; high. Clay body #1, thrown and hand-built, salt fired to cone 10. Glaze #1 inside and out, sprayed with engobe #1 and cobalt carbonate. China paint decal, feathers.</td>
<td>33</td>
</tr>
<tr>
<td>#6</td>
<td>&quot;To Stoney&quot; 15&quot; high. Clay body #1, press molded and hand-built, salt fired to cone 10. Sprayed with engobe #1 and cobalt carbonate. China paint decal and silver and mother-of-pearl luster.</td>
<td>34-35</td>
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<tr>
<td>#7</td>
<td>Egg carton 10&quot; long. Carton: clay body #4, Eggs: clay body #3. Salt fired to cone 10. China paint decal, commercial decals.</td>
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<tr>
<td>#8</td>
<td>&quot;Of Dreams&quot; 15&quot; high. Clay body #1, press molded and hand-built. Sprayed with engobe #2 and fired to cone 4, commercial underglazes and glaze #2 fired to cone 06. China paint decals and gold luster.</td>
<td>37-38</td>
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APPENDIX A
Formulas

CLAY BODIES

#1 Cone 9-10 Light Salt/Stoneware

Cedar Heights Goldart 40
A. P. Green Fireclay 40
Tennessee #7 Ball 10
Custer Feldspar 10

#2 Cone 9-10 Stoneware/Salt

Cedar Heights Goldart 70
A. P. Green Fireclay 15
Tennessee #7 Ball 10
Custer Feldspar 10
20 Mesh Grog 10
Red Iron Oxide 200 grams

#2 Cone 9-10 Porcelain

EPK Kaolin 45
Flint 15
Kona Feldspar 15
Nepheline Syenite 10
Tennessee #7 Ball 15
Bentonite 1

#4 Cone 9-10 Porcelain Casting Body

Tennessee #7 Ball 75 lbs.
Kingman Feldspar 37.5 lbs.
Flint 37.5 lbs.
Water 52.5 lbs.
N Brand NaSiO2 135 cc.
ENGOBES

#1 Cone 9-10 Porcelain Slip

- EPK Kaolin 25
- Tennessee #7 Ball 25
- Flint 25
- Custer Feldspar 25

#2 Cone 4 White Slip (George Sacco)

- Georgia Kaolin 14.5
- Tennessee #7 Ball 4.8
- EPK Kaolin 29.2
- Custer Feldspar 19.4
- Flint 29.2
- Talc 2.9

GLAZES

#1 Soft Albany (Peter Sohngen) Cone 9-10 Salt

- Albany Slip 66
- Wollastonite 26.4
- Calcined EPK Kaolin 6.6
- Milled Rutile 2.64

#2 Cone 06-05 Clear

- Frit 3304 95
- Bentonite 5
APPENDIX B
List of Suppliers

Photographic Equipment, Kodak Graphic Arts Books:

Photogenesis
4930 North High Street
Columbus, Ohio 43214

Don McAlister Camera Company
1132 West Fifth Avenue
Columbus, Ohio 43212

Salem Graphic Supply Company
1445 Grandview Avenue
Columbus, Ohio 43212

Decal Medium & Covercoat:

L. Reusch & Company
2-6 Lister Avenue
Newark, New Jersey 07105

Overglazes and China Paints:

L. Reusch & Company (see above)

Keller Ceramics
3430 Indianola Avenue
Columbus, Ohio 43214

Ceramic Color and Chemical Manufacturing Company
Box 297
New Brighton, Pennsylvania 15066

Stewart Clay Company
133 Mulberry Street
New York, New York 10013

Decal Paper, Silk Screen Equipment:

Cherry's H. Cole Company
59 East Spring Street
Columbus, Ohio 43215
Decal Paper, Silk Screen Equipment: (Continued)
Ford Process Supply Company
1228 Refugee Lane
Columbus, Ohio 43207
BIBLIOGRAPHY


