ART AND TECHNOLOGY: AN ANALYSIS OF THIS RELATIONSHIP IN THE FIELD OF GRAPHIC ART SINCE 1960, WITH SPECIFIC EMPHASIS ON THE DEVELOPMENT OF PRINTMAKING

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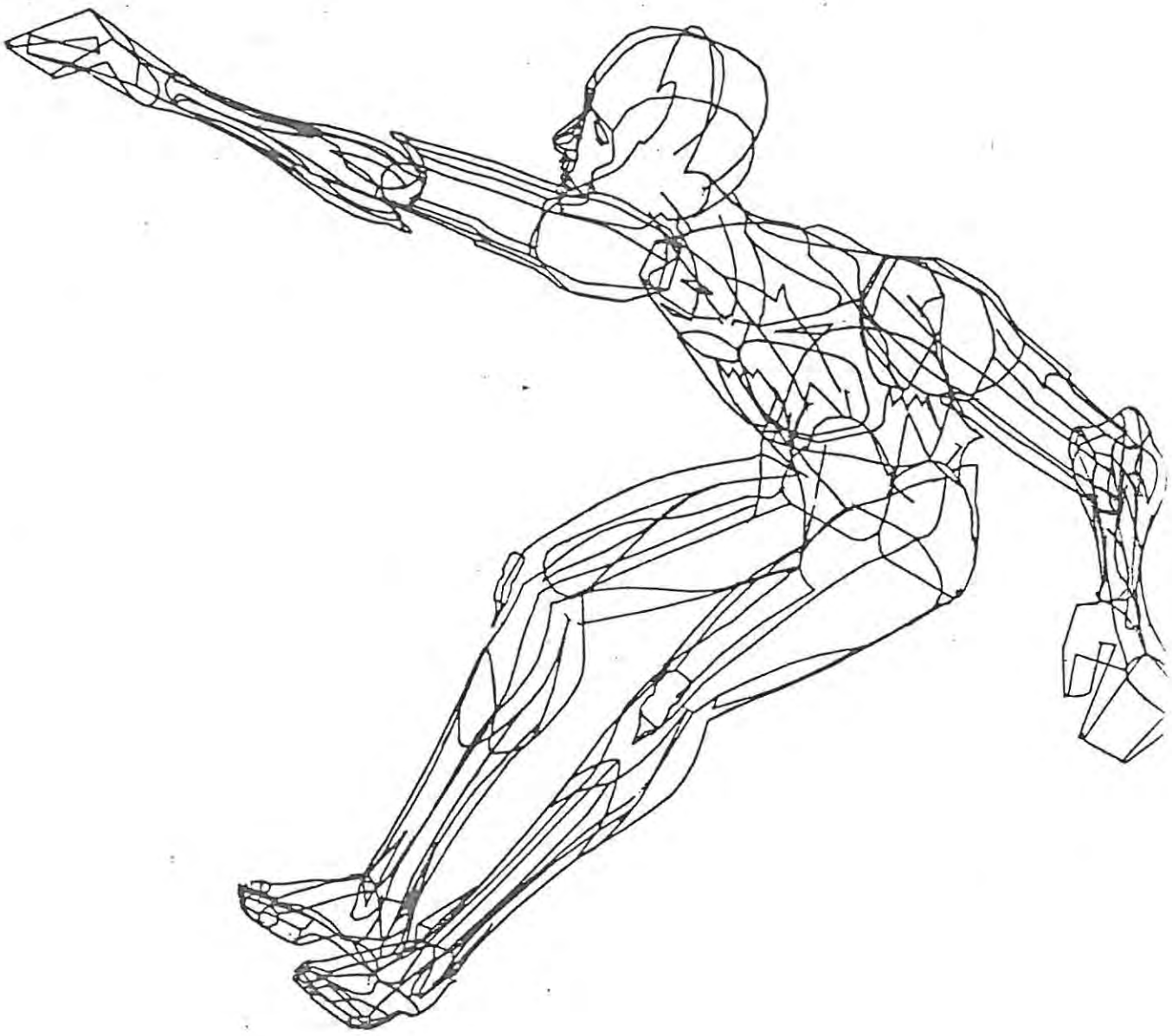
"Graphic artists who learn to adopt technology and develop hybrids will succeed, while craftsmen steeped in archaic traditions, with both feet in the past, will 'die'"

Ken Tyler, initiator of Gemini G.E.L., Los Angeles, California.



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INTRODUCTION

The relationship between technology and art today is a logical extension of a collaborative tradition with ancient roots. The artist has always been a principal perpetrator of technological innovation. He, through the natural progression of technical means, has virtually evolved each new art form. There are many examples such as the 'lost wax' casting process, Jan Van Eycks oil paint innovations, Senefelders 'chemical printing' and Niecephore Niepce's first eight hour photographic exposures. Even woodblocks were in their time an innovation. All art uses technology of a kind and artists who prefer to remain aloof from it are in fact merely using technologies absorbed in older traditional media further back in the history of art.

It is the flexibility of art to adapt to changing conditions of the world today which has spurred change and brought about a new dynamism in the graphic arts. The present intensity of interest in the print can be directly attributed to the advancement of technology and communication in this century. A whole new field of materials, methods and techniques are now available to the venturesome graphic artist and printmaker. Along with the contemporary technology dedication to expression leads naturally to innovation in aesthetics.

The print has its roots in the history of communication and the need for pictorial imagery and for mass communication. The basic desire to reproduce an image ranges from mans early hand prints in the Lescaux Caves to the modern print as a by-product of a constantly evolving technological process.

The field of graphic art has never been static - its media have been constantly

developing. Innovative printmaking has enjoyed an energetic evolution through to our present time. The invention of the printing press by Gutenberg in Nürnburg circa 1450 was extremely important to the development of printmaking. The woodcut and relief method of printing were employed for the first time for mass production and communication. Albrecht Dürer was extremely instrumental in revolutionizing the concept of the woodcut. Dürer elevated the medium to an art form which could stand strongly on its own, free from previous restraints of text. He was aware of the mediums limitations as well as its aesthetic possibilities which he promoted. Metal cut and relief etching was also employed, along with wood engraving, for reproductive printing. Dürer and Lucas van Leyden worked extensively in the engraving mediums. William Blake combined metal cut and relief etching for book illustration.

The 'print look' has been affected by technological inventions from these early times. Steel engraving replaced woodcutting during the Sixteenth Century because it was possible to obtain a more accurate line and more realistic detail. This coincided with an increase in literacy and less of a need for instantly recognizable imagery and symbols, which the woodcut achieved so well. During the seventeenth century etching took over from engraving because it was easier and quicker to obtain the effects of engraving. Mezzotint was replaced by aquatint as a method of obtaining tone. Van Dyck, Hercules Segers and Rembrandt all did experiments with etching processes. Rembrandt furthered the artistic possibilities of the medium much in the same way as Dürer had done with woodcut and engraving.

Francisco Goya also did extensive experiments in the intaglio mediums, especially aquatint, which has had a lasting influence. Lithography, during

the Nineteenth Century, replaced etching as the main reproductive print medium. It was faster, more efficient, accurate and colour was easily achieved. Lithography remains as the primary commercial print medium to this day. The camera, accurate and even faster has further revolutionized printing.

The print mediums which grew out of the commercial need for reproduction have never died though. The artist, with his need to create new images and expand possibilities, has continued to spurr non-stop experimentation within their boundaries. This has led to a new creative use of existing procedures as well as the use of technology and new discoveries for expansion of means to originate new images. The extensions and adaptations are an integral part of the history of the print.

There is no period that is on a par with the dynamism and multiformity of progress which has taken place within the graphic arts during the last twenty years. The resultant rapidly changing art forms are characterised by a multitude of innovative processes, techniques, new materials, presses and tools. There is also an independent growing print aesthetic.

One can no longer apply absolute definitions to the print but certain inherited and absorbed characteristics remain. A prints identity as a 'multiple' is one of these characteristics although an artist can create just one single monoprint from a printing surface. The norm to print an edition of prints has been established and remains. It is, after all, to a large degree still the role of the print medium to convey an image to a wider audience than would benefit from a single work. Prints are less expensive, more available original works and a means of increasing an artists output as well as

exploring new ways of expression. Today most artists working in the print idiom determine edition size, sign and number their prints, and if not printed by himself, check that they meet his standards and requirements.

The artist must accept the tradition of the flexibility of art and the challenge of accelerated technology. The function of technology and related techniques must though be viewed by the artist as a vehicle to enhance and further means but never to dominate or substitute for the creative act. There is no reason for the print to be subservient to technology.

Although some prints defy classification much of the advancement has been in the traditional fields of printmaking - Relief, Intaglio, Planographic and Serigraphy. These indespensible areas will be investigated separately along with new alternate and expanded print mediums.

CHAPTER ONE

RELIEF PRINTMAKING

A relief print is an image produced by transfer from a raised inked surface to a sheet of paper or other printing surface.

Relief printmaking is probably the most direct of the major processes. The main characteristic is the raised surface of the 'block' or 'plate' which holds the ink for printing. There are few boundaries to the visual possibilities capable through adaptations of relief printmaking. The aesthetic freedom of the Twentieth Century artist has enabled him to experiment and utilize the medium to the full.

Until recently the materials used for relief printing were limited to wood and sometimes metal. The search for new materials capable of helping the expansion of image has been a natural outgrowth of the changing print in the last two decades. There has become an awareness of the potential of new materials, often developed for industry, that can be creatively exploited. Plastics, solid and malleable, are available. Aesthetics have changed to allow virtually any object which can be inked to be printed.

Contemporary Relief Methods

Perspex, Lucite and Plexiglass

A large number of plastics are being used by printmakers today for a wide variety of purposes. The solid plastics available in sheets have the

advantage over woods in that they are obtainable in large dimensions and have a consistent density. The transparency of these materials can also be a great advantage for print registration and preparatory drawing. The rigid plastics are normally cut and gouged like wood but it is advisable to remember that limitations of new materials are always blatent when approached conventionally. It is often better to treat a new material according to its own characteristics and in this way exploit the possibilities. These hard plastics are ideal for working into with power tools such as vibrogravers, wire brushes, drills and sanding attachments. They can be sanded, sandblasted, filed and textured in hundreds of ways. They are also very easy to cut with a jig or hacksaw into intricate shapes that can be assembled. The surfaces can also be very effectively treated with solvents, caustic chemicals and heat to obtain a variety of textural effects.

Liquid plastics such as polyester resins, polyvinyl acetates and liquid acrylics are also very exciting to the adventursome printmaker. They are being increasingly used and experimented with. Boris Margo, an American artist, through his experimentation in this field has developed a process called the cellocut. It is basically the use of a liquid plastic - sheet celluloid dissolved in acetone. Margo's earliest experiments were drypoint on celluloid and out of this grew a technique of building up thicker areas with liquid celluloid and impressing textures into them. These areas could then be reworked with various tools and printed in normal relief manner. These prints were a forerunner of the collagraph which will be discussed in a later section.

Cardboard Relief Printing

The cardboard print has grown out of basic relief woodcut methods. The easy availability, flexibility and inexpense of cardboard and other mat boards enable them to be used in a variety of relief print ways.

The basic method involves cutting the card into different shapes, sealing, inking each section with rollers and reassembling before printing by burnishing or with a press. The variety of images which can be created depends on the height, density, texture and application of the cardboard.

Ink can be applied to specific areas by using a stencil and also by making use of very small format rollers.

The cardboard can be sealed with any of the newer lacquer sprays and glues, polyurethane varnish or acrylic polymer. The sealer preserves the card during printing and cleaning.

Other ways of treating the cardboard relief print are traditional cutting into the surface with woodcut tools, removing layers of card to alter the surface height, glueing additional pieces on, embossing textures into the card, and building up textured surfaces with modelling pastes. It is also possible to use thin wood veneers, masonite and fabrics. The various surfaces can also be inked with rollers of different hardness and softness to ink separate levels.

Collage Print

This type of print has limitless scope - any found object that can be inked with a roller can be printed. The process is an additive one, unlike most of the other relief methods which are reductive in nature - negative areas are cut away. Michael Rothenstein, a major influence in the field of experimental relief printmaking, has made extensive use of found objects. Experimentation is the crux - one has to manipulate and explore the objects various print qualities being careful that the print does not merely become a repeditive after-image of the object. To quote Rothenstein "He (the artist) can get images from almost any flat object or surface that can be covered with ink and that is tough enough to withstand the necessary pressure for printing: a face of eroded stone, a section cut through a tree, a fragment of tortured metal found on a beach"[1]

Lino-cut Printing

The lino-cut print has been avoided by many artists due to its use in schools for introductory printmaking. It has though been used by artists such as Matisse and Picasso and been manipulated to great advantage in the field of the contemporary print. It can offer infinite creative scope.

It can be treated in much the same way as a smooth, fine textured plankwood but

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1 Rothenstein, M. Frontiers of Printmaking, p.14.

has the advantage of being able to be cut easily in any direction due to its uniform density. Although lino does not have a grain it is not as 'dead' as it may at first appear. It does have a slightly granular surface which is capable of subtle texture. This surface can also be deliberately indented, pitted and embossed with sandpaper, powertools and any other hard object.

Linoleum can also be very successfully etched with caustic soda (sodium hydroxide). A saturated solution can be applied directly to the surface to obtain different textural effects. It can be brushed on, but to obtain a controlled shape or line one needs to use an acid resist such as liquid etching ground, asphaltum or even candle wax to paint out the positive areas. The resist can also be incised and drawn through before biting with the caustic soda. This will give a rough, granular linear effect.

Lino is also very suitable for blind embossing and inkless printing due to its easy cutting and good durability.

Plaster Relief Printing

The Plaster Relief print is another method of obtaining varied graphic effects which has in recent years become popular. The printing 'plate' is cast in plaster and worked while still in a fairly wet state and also after it has dried. Plaster of Paris is suitable although other plasters can be used. It is mixed as directed and poured into a frame mould of approximately two centimetres height and with a flat base surface, such as glass. It is this surface which becomes the printing surface. The plaster can be reinforced in the centre with wire mesh. It can, in its semi-dry state be worked easily with cutting tools and textures embossed into it. When dry it is much harder

but can be worked into with conventional wood-cutting tools as well as engraved with a drypoint needle to give fine detail. The plaster also has the capability of being able to be built up, corrected and reworked even after it is dry. It is printed as a conventional relief print and normally by burnishing rather than by the use of a press. Before the plate is inked it is a good practice to seal the surface in the same manner as a cardboard print plate is sealed. Other materials such as marble dust combined with an acrylic medium, calcium carbonate and acrylic medium, dental plaster, and some clays can also be employed to create a cast printing surface suitable for relief applications.

Metal Relief Printing

A technique of printing relief off a metal plate was invented around the turn of the Nineteenth Century. The metal cut existed earlier but did not make use of acid to create the negative areas. William Blake conceived of relief etching as a labour-saving way of printing. It was really a reversal of the traditional intaglio technique. Blake would block-out, with an acid resist, the printing areas on the copper plate and deep etch the plate. The plate could then be relief inked and printed simply. William Blake, an eccentric genius, also invented a way of transferring his writings to the copper plate by first writing on paper with a mixture of asphaltum resin and spirits and then transferring it by pressure to the plate. These early relief etchings were at the time financial failures but are now recognised as artistic and literary gems and priceless. Blake also experimented with wood engraving and monoprints and was one of the prints most forceful early innovators.

The rediscovery of the medium about a hundred years later has been credited to

S.W. Hayter of Atelier 17 fame. It has in recent years been very successfully manipulated and experimented with. The technique still remains basically the same with the image being blocked-out, negative areas deep etched in dilute acid and the resulting raised surfaces inked and printed in relief. The plates can be printed on virtually any type of press. The metal plate can also be treated or combined as a relief cutting surface - employing burin engraving but remembering that the negative incised lines are not printed.

The metal plate can also be treated photographically in the same way as for photo-etching, using a photo-sensitised emulsion as the acid resist.

There are also many relief effects being created on metal plates using welding, brazing, soldering and power tools. Rolf Nesch, a German printmaker, has been a pioneer in this field of sculptural metal collage printing. The process is additive in that no acid is used, and the elements are treated like a montage.

Another artist working in this idiom is Michel Ponce de Lèon who often uses paper of two centimeter thickness and specially made to print his relief metal plates. The paper needs to be flexible to accommodate the varying relief. Ponce de Lèon has also designed a new type of hydraulic press which can exert incredible vertical pressure and accept plates of any height. He describes the press as "what an instrument is to a musician, for with it I am able to extract every nuance of ink and embossment from my dimentional plates."[1]

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[1] Eichenberg, J. The Art of the Print, p.335.

CHAPTER TWO

INTAGLIO PRINTMAKING

Intaglio printmaking encompasses a number of techniques which all involve the incision of the image into the printing surface. The incised lines and depressed surfaces are filled with ink which is transferred under pressure onto the printing paper or other surface.

The development of the intaglio process has, in recent years, been unparalleled in its exploration of technique and image. During the 1930's Stanley William Hayter established Atelier 17 in Paris which became the centre of experimental graphics. Much of the creative use of the intaglio processes is indebted to these early experiments which have led to etching and engraving being reinstated as contemporary graphic techniques.

The range and flexibility of the medium can accommodate a diversity of styles. The basic techniques have not changed very much in hundreds of years. The change has been rather in a development of certain procedures coupled with a new discovery of the potential of the intaglio medium.

Contemporary Intaglio Trends

Perspex and other plastics

As discussed in the section relief printmaking plastics are now being used in the graphic arts field quite extensively. They can be used in the same ways as for relief printmaking with the difference being that the incised marks

hold the ink, the surface wiped clean and the image transferred under pressure to paper. Perspex can be engraved with burins or worked into with a drypoint needle. The marks tend to combine the characteristics of drypoint and engraving - a feathery line combined with line of varying thickness. Tones are achieved by sanding, powertools and use of various solvents depending on the plastic. The transparency of these plastics enables easy registration for colour work and transferring image to plate.

The cellocut technique, described in the previous section, can also be printed intaglio.

New aquatint methods

The process of aquatint, which enables one to print tone from a metal plate, using powdered resin has not changed since the Eighteenth Century. There have, though, developed other ways of obtaining either aquatint or tonal effects on metal plates.

Enamel spray paint or lacquer spray paint in cans is a very fast method of obtaining an aquatint. The paint is sufficiently acid resistant to use for quite long bites. One starts spraying off the plate as a test and then works back and forth stopping,once again, off the plate to prevent spitting.

The spray paint has the advantage that it dries very quickly and does not need heating to adhere it. It is also excellent for creating uniform tonal areas and tonal gradations from light to dark. One must also remember that the texture of spray differs from aquatint and therefore should not be used as a complete substitute.

An air brush can also be used very successfully with enamel paint but also needs practice for subtle tones.

Sandpaper aquatint is a method of obtaining tone through using sandpaper, glasspaper or emery cloth. The effect tends to be crude but quick, effective and resiliant during printing. There are two variations of the method. The one uses a hard ground over which is placed a sheet of fine sandpaper face down on the plate. The plate and sandpaper are passed through the press at reduced pressure a few times, moving the sandpaper fractionally each run. The particles of sand puncture the ground allowing the acid to bite the plate in the exposed areas.

The other method involves simply running the plte, with sandpaper face down on the polished surface, through the press under considerable pressure. Each grain of sand pits the metal plate and the drypoint effect varies depending on the grade of sandpaper, number of times the plate is run through the press and the pressure applied.

Sand-blasting has also been used to obtain areas of tone on a metal plate. A sand-blaster or air brush fitted with a blasting tip adjustment can be used. Rubber cement glue is used as a block out to deflect the particles. Carborundum or sand can be used of varying degrees of coarseness. Experimentation is needed, but once mastered this method can give tones and textures of its own.

The Flour of Sulphur Method, although not a very new method, is being used quite commonly again for obtaining delicate tints on copperplates. Olive

oil is painted on the required area and flowers (or flour) of Sulphur (precipitated Sulphur powder) are shaken into the oil. The plate is then left for a couple of hours. The Sulphur bites into the plate due to a mild oxidising effect and creates delicate, soft wash tones.

Acid Resists

Acid resists are no longer restricted to the traditional asphaltum stopping out varnishes. Different types of enamel and lacquers are now sold in paint and spraycan form. Liquid resins and plastic based paints are available and also serve as blocking out mediums. Vinyl 'stick on material' such as Contact and Fablon insulating and masking tapes also make very good acid resists and are very useful for obtaining straight edges as well as for blocking out large areas. They have advantages of being able to be cut quickly into any shape, stuck directly to the plate and easily removed after biting.

Power Tools

In the intaglio processes, as with relief printmaking, power tools are being used very frequently and unashamedly. There are several types of power tools available today which are useful to the graphic artist. These tools speed up certain work and enable one to obtain original textural effects. They have become very much part of a printmakers tools.

The simplest and most versatile is the electric drill. It can be fitted with drill bits, wire brushes, rasps, drum carborundums and other grinding attachments. Disused dentist drills have also been very successfully used

for working intaglio plates.

Vibrating tools such as a Vibro-Graver can also be used with flexible shafts and various attachments. It can create a very versatile range of lines and textures.

Hacksaws, fretsaws and jigsaws for metal work are also very useful. Cut plate techniques for colour and multiple plate compositions are now quite commonly used.

Welding and brazing are also used to extend the intaglio possibilities - plates can be built up, shaped plates joined, and surface effects cut into the surfaces. Soldering can also be used to repair and add to plates as can epoxy resins and lacquers. These can be applied to the plate and worked while wet or engraved when dry.

Printing Processes

As with most of the basic intaglio procedures little has changed since the 1500's. This is true in the simple 'one colour' and 'multiple plate colour printing' methods. There are though a few new techniques in intaglio colour printing which have gained popularity in recent years.

Surface Rolling

For this method the intaglio plate is inked and wiped in the conventional manner. A layer of a differing colour letterpress ink is then rolled over the plate surface. Ideally this ink should be thin and evenly rolled with a hard

composition roller, capable of covering the whole plate in one run of the roller. If the roller is not large enough one runs the risk of contaminating the colour through offset and pulling ink out of the incised lines. The plate is printed in the usual manner for intaglio. This is one of the easiest methods of obtaining a two colour intaglio print from a single plate.

Transfer Surface Rolling

An image or design (or part of a design) can be transferred via a large composition roller to the intaglio plate which is then printed. In this method one can combine two or more images or designs from different plates or blocks in a single print run. The printing blocks or plates from which the parts of the image are transferred are normally relief rolled in their respective colours. The composition roller is then rolled over the surface(s) and picks up the design. It is then rolled over the intaglio plate off-setting (depositing) the design onto the surface.

With the use of this method one can combine and print intaglio and relief effects (as well as textural effects taken from surfaces that cannot be run through a press) on an intaglio printing plate. The crucial factor in this technique is registration. The blocks and plates need to be registered in a measured order so that the composition roller will off-set the desired image correctly. It is also very important that the circumference of the composition roller is sufficient to carry the design for off-setting.

Multilevel Viscosity Intaglio Printing

This system, whereby several colours can be printed simultaneously off one

plate, was developed by Stanley William Hayter at his Studio Seventeen. The method is a sophisticated surface rolling technique. The basic principle operating is that the adhesion of one colour ink rolled on over another can be controlled by the differing viscosities of the inks. An ink of high viscosity will not adhere to one of a lower viscosity while in a wet state. The method depends really on three variants - the viscosities of the inks used, the depths of the bitten surfaces of the plate, and the relative hardness of the composition rollers used.

To start with the intaglio plate is inked and wiped with etching ink which is normally of a high viscosity - quite stiff. A large soft roller is inked with medium viscosity letterpess ink and rolled over the plate with heavy pressure. This inks the deepest recesses of the plate and does not adhere to the heavier intaglio ink. Next a medium hardness roller with an ink of less viscosity is used. This inking reaches only the higher relief surfaces of the plate and because of its viscosity will adhere to the previous colour on those surfaces and cover it. Finally one can use a hard roller with an even less viscous ink on the highest parts of the plate.

The composition rollers used should be large enough to cover the plate surface in one run.

To make an ink more viscous Magnesium Carbonate or Aluminium Sterate can be added. To make it less viscous add linseed oil or light plate oil. It is also possible to add a retarding agent or oil of cloves or caster oil to slow down the drying time of the ink to prevent it drying on the plate.

This method of printing can create textures and nuances unobtainable through

using other techniques.

Stencil Inking

A colour print can be obtained from a single intaglio plate by the stencil process. In this method the colour areas must be planned accordingly in advance. Stencils are cut to the desired shapes from ink resistant paper, acetate or thin sheet metal. The plate is first inked in the intaglio manner, the stencil(s) placed over the plate, and ink such as letterpress ink rolled with a soft composition roller through the stencil(s) onto the plate. One must be careful not to have too many colours overlapping as this can lead to many problems.

Plaster Printing

An intaglio plate, which has been worked in any of the techniques, can be 'printed' onto plaster. This type of print has been done to obtain a proof when a press has not been available and more recently executed as prints or works in their own right.

The plate is inked in the usual manner, placed face upward on a smooth surface such as glass, a frame of approximately two centimetres high placed around the plate, Plaster of Paris (plaster cement, hydrocal, or other plaster) of a fairly thin consistency poured into the frame and allowed to set. The plaster can be re-inforced with fabric or wire mesh. After the plaster has set the plate can be carefully removed and the resultant surface image sealed with an acrylic spray.

Photoetching

Photography has increasingly become a frequent component of the contemporary print and the use of it is found in virtually all the autographic processes.

Photoetching has since the 1960's enjoyed technical advances which have made it far more easier to use in the average print-studio and also boosted its potential for expansion of image making. Photoetching has also changed from a merely photographic reproductive process to a major expressive medium.

The technique involves the exposure of a photo-sensitised plate, through a photographic transparency, to ultraviolet light or light of a similar wavelength. The unexposed parts of the plate, after developing and biting, become the image holding parts of the plate.

The process starts with a normal continuous tone negative which is transferred via an enlarger onto high contrast orthochromatic film (also known as 'lithfilm', or 'orthofilm' or 'linefilm') to obtain a positive transparency of desired size. A scrupulously prepared and degreased etching plate is then coated with light-sensitive acid resist according to manufacturers directions - usually under darkroom safe-light conditions. Kodak Photo Resist (K.P.R.) is excellent for this use. When the coating is dry it is contacted with the positive transparency and exposed on a vacuum exposure table for the specific time. It can also be half-tone screened if required. The plate is then developed in the photo-resist developer, under safe-light conditions, and washed in water until the image is visible.

The plate is now ready to be etched in a weak solution of acid. Any areas

which need to be aquatinted must be done prior to the biting. Before printing the acid resist is removed with lacquer-thinner. The plate is inked, wiped and printed in the intaglio manner for line etching.

CHAPTER THREE

LITHOGRAPHY - PLANOGRAPHIC

Lithography is a planographic medium - the image and non printing areas are on the same level of the plate or stone.

Lithography was invented in the 1790's by Alois Senefelder. During his search for a method to reproduce sheet music he wrote on paper with grease, pressed this against flat limestone, soaked the stone in water, rolled on printing ink which only adhered to the areas where the grease repelled the water, and pressed paper against the stone. This process Senefelder named 'chemical painting' or Polyautography.

This simple process, based on the antipathy of grease and water, developed quickly and variations were investigated. It soon became known as lithography and grew into the major printing medium.

Some of the most innovative printmaking being created today is in the field of lithography and combined media. The traditional stone lithography has changed little since its early days of invention. The advances lie largely with the invention of metal plate lithography, advances in printing and presses, and photolithography.

Lithography has, through combining and mixing various techniques, as well as by modifying traditional materials, expanded its potention virtually without limits. There has been a tremendous resurgence of lithography throughout the world in recent years and particularly since 1960. Artists like

Sutherland, Moore, Hockney, Paolozzi, Marini, Chagall and Picasso (who destroyed much of the dogma surrounding the medium) are but a few who have worked in the medium in an attempt once again to expand their expressive range.

The initial convergence of this new interest was in New York during the 1960's with print-studios such as Universal Limited Art Editions, Pratt Contemporaries and most important Tamarind Lithography Workshop - which invited artists to work and stimulate the medium. Tamarind developed technical knowledge, revived the workshop tradition and trained master artist-printers, many of which have in turn opened their own print studios and workshops.

Plate Lithography

The traditional Bavarian limestone is still quite widely used in many print workshops throughout the world, but metal plates are now being increasingly used. This is largely due to the unsuitability of heavy and expensive stones. Zinc and aluminium plates are now extensively used due to their easy availability, portability and storage. They are also easily cut to various sizes. Unlike the stones the metal plates are non-porous and must be grained to give them a 'tooth' to retain the grease and water. This is done commercially during their manufacture by whirling steel balls over the surface. Coarse ball grained aluminium plates are the most popular ones today.

Prior to commencing drawing on the metal plate, it must be deoxidised with a saturated solution of alum and water which is flooded over the surface of the

plate a few times. The margin edges of the plate are masked out with gum arabic along with any areas which must remain white. The image is then drawn with the traditional lithographic vehicles - litho crayons, tusche and other wash effects. A separate plate is needed for each colour. When the image is dry it is dusted with a fine layer of French chalk or talcum powder. The plate is then coated with a thin, even coat of either a commercially prepared etch or one made up of 20 parts gum arabic to one part Phosphoric Acid. It is then fan or blow dried. The image is now washed out with turpentine until all the black is removed. The surface is wiped with a clean sponge. The image is established by rollering with printing ink and a lithographic roller or on a proofing press. When a thin even layer of ink has been applied and one is satisfied with the proofs pulled, the plate is again dusted with French chalk and 'etched' a second time to condition the plate and guarantee clarity of printing. It can also establish subtle detail which might otherwise be lost. The plate is now ready for printing in the usual manner either on a direct hand litho press or on an off-set proofing press.

Multimetal Laminated Plates

The normal zinc or aluminium lithographic plate is a thin sheet of one metal. Bimetal lithographic plates are made of two laminated layers of different metals, usually copper plated onto an aluminium or stainless steel base. Trimetal plates have another layer plated over the copper, usually chrome. The layers are very thin and can be etched away quickly, the acid selecting one metal and not disturbing another.

The main advantage with this process is that copper is very receptive to grease while aluminium, chrome and stainless steel can be easily receptive to

water.

The image can be put on the plate by any of the normal lithographic means which are acid resistant. The plate is then actually bitten with the selected acid (unlike the zinc and aluminium plates where the 'etch' merely activates the greasy qualities in the ink and does not affect the surface of the plate) for a period long enough to dissolve the unwanted metal - usually about two minutes. The positive copper image remaining is inked with rubbing-up ink and covered with gum etch. The rub-up ink is removed with turpentine and the gum etch with water. The plate is printed on a scraper litho press, offset proofing press or even on an etching press with good results.

Paper Plate Lithography

Paper plates were invented by Anthony Eusink of Chicago during the Second World War for easy field printing. These paper plates have since then developed rapidly and are now often used in art schools and colleges. They have advantages in that they are easy to draw on using the usual lithographic means, are very easily transported, need no toxic solutions to process them and they are relatively cheap.

The paper plate consists of a coating of waterproof compound on paper, overlaid with a layer of grease receptive compound made from alginates, china clay barium sulphate, calcium carbonate and titanium dioxide.

After the plate has been worked onto, it is covered with desensitizing solution. It is rolled up with proofing ink and about six proofs taken either on an offset press or transfer press. The plate is then left for about one

hour before continuing with the printing. The quality of tone and size of print runs obtainable from paper plates, does not compare with stones and metal plates but paper plates retain their advantages.

New Lithographic Drawing Mediums, Vehicles and Techniques.

The traditional methods of working on a litho stone or plate are still used but many new ways have been developed in the last couple of decades. Many of these have played an important role in the continuing popularity of lithography as a 'direct' printmaking medium.

Rubbing Ink

Rubbing Ink is obtainable in three grades of hard, medium and soft and is used primarily for hazy and cloudy effects. It can also be used for gradated tonal ranges. It is applied by covering a finger with soft cloth, rubbing it on the solid block of Rubbing Ink and then onto the stone or plate. It is normally built up slowly to the desired tone.

Autographic Ink

Autographic Ink, also known as Zincographic Ink is a very smooth ink designed for fine work with a pen. It can be diluted like tusche with water. It is especially effective for use on metal plates because of its high grease content.

Polymer Tusche

Polymer Tusche consists of equal parts Liquitex Medium, Liquitex black and distilled water. One can use other brands of acrylic medium and black as substitutes. The mixture is allowed to mature overnight and then strained to remove any large particles. It can be applied in many ways as with conventional Tusche.

Tusche washes

Tusche can be very successfully mixed with spirit based solvents to create many textural possibilities. They are applied directly to the plate or stone as water washes. The surface can also be flooded with solvent before hand and then Tusche floated onto the solvent. Many different solvents such as turpentine, white spirit, petrol, xylene, paraffin, surgical spirit and washout solution can be experimented with.

Lithoaquatint Technique

This technique is used to obtain tonal effects on metal lithographic plates. Non-image areas are blocked out with gum arabic. Anhydrous alcohol is then floated onto the plates in the tonal areas. Powdered asphaltum is then sprinkled or dusted onto the alcohol which acts as a carrying vehicle. The textural effects possible depend on brushing, sprinkling and dusting and are controlable and different. When the alcohol evaporates it leaves the asphaltum particles that were suspended on the plate. The plate is then carefully heated so that the particles melt and adhere to the plate. The plate is then etched in the usual manner. Before printing the asphaltum is

washed out with lithotine or turpentine. The asphaltum particles are visible during the process and are therefore a true reflection of the tonality achieved. A very even aquatint can be obtained if the powdered asphaltum is transferred to the plate by an aquatint box or traditional muslin bag.

Airbrush

The airbrush is a fairly new 'tool' which has been used quite extensively by contemporary artists. It has given rise to effects which could otherwise not be achieved by traditional methods. It needs, though, technical dexterity as well as practice in order to become competent in the use of airbrush in lithography. One needs a knowledge of chemical properties in the inks and solvents used in lithography. All the tusche washes can be applied with an airbrush very successfully. It has been used extensively in recent years to obtain delicate tonal detail and textures.

Transfer Paper

Transfer paper for lithographic use is virtually as old as the medium itself, but with the recent popularity of the print many new improved commercially prepared transfer papers have become readily available. These transfer papers have normally been sized on one side with albumen, starch or gum solutions which makes delicate transferring possible. This water soluble coating on quality stable paper is the drawing surface. When the back of the paper is moistened the coating dissolves transferring the image onto the stone or plate. Many techniques are made possible through the use of transfer paper. Rubbings of textured surfaces and objects, collaged images, montype transfers and relief transfers are possible.

There are many types of imported transfer papers available, which often have their own characteristics and applications. It is also possible to make ones own paper for transfer. The most popular commercial papers are Everdamp Paper, White or Opaque. Transfer Paper, Transparent Transfer Paper and Yellow Transfer Paper.

Roller Transfer

Any inked image or texture, off a relief block or other surface, can be transferred via a large composition roller to a stone or plate in a simple offset manner. The relief surface must be inked in a suitable greasy ink such as 'press-black'.

Xylene Transfer

Xylene, an isometric, colourless solvent of hydrocarbons, can be used to transfer printed reproductions onto stones or plates. The printed material should be on good quality paper and printed preferably with unmodified offset ink. The printed design or image from a magazine or newspaper is placed face down on the stone or plate and a cotton pad, soaked with xylene is used on the back to loosen the ink and transfer it from the supporting paper onto the lithographic surface. After the xylene has evaporated leaving the greasy ink behind and any further work has been added, the plate or stone is etched and carefully proofed.

Image Burning

This technique is practiced quite frequently on limestone to enable very long print runs to be done without the printing surface breaking up.

The image is inked thinly, dried and then dusted with powdered asphaltum. Any excess asphaltum is washed away with water. A flame from a blowtorch is then turned on the image until the ink and asphaltum coalesce. This reaction causes the grease to penetrate the limestone further than normal and forms an acid resistant image area. The stone is then slightly relief etched with gum-nitric solution to define the areas even further.

Lacquering Metal Litho Plates

This technique has a similar purpose to burning an image on limestone in that it reinforces the design and makes it virtually indestructable. It involves replacing the image with a non-blinding vinyl lacquer (a lacquer that will accept lithographic ink). This process establishes the work on the plate in an invunerable manner so that it can be repeatedly etched and stand long print runs. In this method no delicate tones are lost.

The lacquer is applied after normal plate processing and double etching. The plate is inked, dried and dusted with talc. It is then evenly gummed and completely dried. The image is then washed out. The plate lacquer is applied evenly and thinly and allowed to dry. A coat of asphaltum wash-out solution is applied, to help attract ink, and dried. The plate is washed with water and is ready to be printed.

Offset Lithography

The offset proof has in the last fifteen years come into its own in the fine art printmaking context. This is again an example of commercial industry (and its related technology) having a direct influence on the fine arts. The experimentation with commercial offset lithography has proved its advantages. There is no lateral inversion of the printed image from the plate, subtle detail is easily and faithfully reproduced and large flat areas are easily printed. Accurate multiplate colour lithographic registration is also readily obtained due to the precision of these presses. The fidelity possible by off-set lithography surpasses all other printing mediums other than possibly very exacting printing off limestone.

Off-set presses are far more advanced than the normal transfer press and also vary in sophistication from hand inked versions with manual paper feed to high speed auto ink and dampening models which can print 9 000 impressions an hour.

The most popular offset press being used for fine art application at the present time is probably the flat-bed offset press. This in its basic form consists of two accurately machined steel beds supported horizontally on a rigid frame. The blanket cylinder, which is covered with a resilient rubber blanket is supported between two large gears which travel on accurately machined racks running the length of the side frames. The plate bed is located at the front of the press and the impression bed, with paper grippers, is positioned exactly the circumference of one cylinder further along the press. This type of press is also normally fitted with a dampening roller and series of inking rollers.

The printing sequence starts with the cylinder travelling on its racks to the front of the press. On this 'stroke' the cylinder does not rotate, but the inking and dampening rollers operate. On the blanket cylinders' return stroke the gears are engaged and the cylinder rotates twice before the back of the press - once to pick up the image from the plate and on the second revolution to offset print the image onto the paper stock on the impression bed.

Photolithography

Photolithography or photo-offset is based on the same principle as lithography. It has gained enormous popularity in recent years. The process involves creating an ink receptive surface image by photographic means. This is done by coating the surface of the plate or stone with a light sensitive material, which is then exposed through a negative transparency. The emulsion which is exposed is hardened by the light and becomes ink receptive, the remainder washes away. Comercially prepared presensitized plates are available as well as photosensitising emulsions which one adheres oneself.

Albumin-Bichromate Coating

This process has been used for a long time and is still used occasionally. It has though, been replaced by 'wipe on' solutions using diazo compounds in their composition. These solutions have the advantage that they are not as critically effected by humidity.

Diazo Wipe-On Compounds

Many companies supply these coatings and they all have virtually the same basic chemistry. The photosensitizer consists of the powder diazo resin and a base solution which when mixed becomes light sensitive. This solution is then wiped onto the surface with a cloth in even strokes, first in one direction and then in another. Once dry, it is contacted emulsion side to emulsion with the transparency and exposed on an exposure table or vacuum down-frame. The image is developed with the developer which is rubbed on until the image is visible and then rinsed off with water. A solution of gum etch is then applied which desensitizes the non-image areas. When dry it is wiped clean and proofed.

Presensitized Metal Litho Plates

These plates are usually fine grained to suit off-set printing procedures rather than hand printing. The plates are coated with a light sensitive coating normally of diazo base. There are also newer plates available with photopolymers and light sensitive polyvinyl alcohol designed for long print runs.

The majority of presensitized litho plates are negative-working. They are contact printed through a negative transparency. There are though some makes which work the alternate way round.

CHAPTER FOUR

SERIGRAPHY

Serigraphy, Silkscreen and Screenprinting are all names for the same stencil method of printing. The technique involves a frame with a tightly stretched fine mesh fabric over it. A stencil is attached to the mesh, ink forced through the interstices of the fabric around the stencil mask, and a print made on the underlying surface.

Serigraphy cannot be attributed to any single inventor - its antecedants are in the history of communication. The earliest examples of 'stencil printing' are probably the hand prints on the cave walls in the Pyrenees Mountains. They are created by blowing paint through hollow reeds and blocking out the negative image with their hands. The hand was the stencil. Later, and better documented, are the stencil methods used in China and Japan in A.D. 500-1 000 which led more directly to the medium as we know it today. They used stencilling of fabric decoration but also considered it an art form on its own. The Japanese developed the process by suspending the stencil parts by strands of silk or hair. This facilitated more intricate designs and led to the silkscreen of contemporary times. It is one of the most recent printmaking processes to attain fine art status. The term "serigraphy" was coined to distinguish the medium from the commercial application for mass production. The Latin 'seri' means silk and 'graphos' is Greek for "to write". The term serigraphy is attributed to Carl Zigrosser an art museum curator in the 1930's.

It was only during the late 1950's and 1960's that serigraphy attained its

acceptance as an avante-garde art medium. There were earlier attempts to promote its creative possibilities but most artists tried to use it to initiate other mediums rather than exploiting its intrinsic characteristics. Serigraphy was a perfect medium for the aesthetic movements of the 1960's. Artists used and exploited commercially gained knowledge rather than feeling intimidiated by the industrial heritage. Movements, such as Pop, thrived on the ease with which their multiple imagery could be reproduced into statements. The Op Movement found the detail and exact registration possible irresistable. The Colour Field artists also experimented with the medium as did the Minimilists who found the precission and 'hard edge' possibilities very seductive.

The serigraph has in recent years undergone vast improvements and is still having its full potential and aesthetic explored. The basic elements of a screen printing set-up - the frame, screen fabric, stencils, squeegee and baseboard have all undergone improvements and refinements. These refinements have been parallel with the changes in attitude toward the medium and its acceptance as a fine art form.

The Frame

The basic frame on which the screen fabric is stretched has changed little in format. The wooden frame is still very common and the cheapest and most easily constructed. There are though advantages in the more expensive metal frames available today. These frames are used extensively in the commercial applications and print workshops. Wood is effected by atmospheric changes and can shrink and expand which in turn can influence the exactness of registration. Metal frames in comparison are stable and very durable. They

are normally made of tubular steel or aluminium. The considerations in preparation of wooden frames applies equally to steel ones - frame flatness, sealing, corners etc. The metal frames are commercially stretched or incorporate a stretching devise.

Mesh Fabrics

Synthetic fabrics have developed greatly in the last decade or so. The original traditional silk is used rarely. This is due to its expense and because the synthetic fabrics are of a higher and more durable quality. The synthetics used are usually nylon or polyester although terylene, metal-polyester, copper and stainless steel meshes are also employed for certain applications.

The mesh fabrics can be divided in two - multifilament and monofilament. These terms refer to the thread characteristics of the material. Monofilament is a fabric made of threads of a single strand or fibre. Multifilament fabrics are made with threads that consist of innumerable interwoven fine strands or fibres. Monofilament fabrics are all synthetic and the best for general all-purpose use. This is because the multifilament threads are bulkier and cannot be woven as finely as monofilament threads and also becuase ink can collect between the filaments, causing cleaning problems. Also many fibres are weaker than a single core. Multifilament construction of mesh can yield better adhesion results for some techniques such as tusche, crayon and indirect stencil applications.

Nylon

Nylon is the most durable of the new synthetic screen meshes and can be used with most solvents. It is manufactured in monofilament taffeta weave. Its main drawbacks are that it stretches when wet and contracts when dry thus being affected by atmospheric changes. Very close registration, especially on large screens, is a problem with nylon due to its instability. It is suited though for printing on uneven surfaces because of its 'give factor'.

Polyester

This mesh fabric is available in both mono and multi-filament forms and are excellent for all techniques. Polyester is much less effected than nylon by atmospheric changes and has very good dimensional stability. It is only slightly less resistant to strong chemical agents. Polyester fabrics also have a very high tensile strength enabling them to be tightly stretched. This coupled with its stability enable high precision work to be easily carried out. Polyester screen fabrics are probably the best and most popular all-purpose meshes being used today.

Metal-Polyester

This mesh has developed from the manufacture of metal and polyester meshes. It consists basically of a metal-clad polyester which combines all advantages of a screen fabric of polyester coupled with the added strength of metal. It is very stable, extremely durable, needs little stretching and is easily pressure cleaned.

Metal Screen Meshes

Metal meshes are made of bronze, copper, brass and stainless steel, Polyesters have replaced most of these meshes although stainless steel is still used for applications where highly abrasive and caustic inks are used, It is used extensively for screening glaze onto pottery,

Squeegees

The squeegee is the devise used to push the ink through the screen and onto the printing surface, It consists of two main parts - the blade and the wooden or metal handle which holds the blade, The blade is the most important element of the squeegee because it determines directly the print results, Blades were originally made from rubber but the technology in synthetics has resulted in improved compositions, The three most common types are Neoprene, Synthetic Rubber and Polyurathane, They are all available in soft, medium and hard ratings,

Neoprene

Neoprene is a black synthetic which can be used with all oil-based and acrylic inks, It wears easily and has the disadvantage of tending to deposit black particles or streaks in light inks when it begins to perish,

Synthetic Rubber

These blades are made of Buna and are normally a grey or tan colour, They can be used with all inks and solvents and wear well,

Polyurethane

Polyurethane blades usually an amber colour, are very durable and resist all solvents. They are very hard wearing. They are compatible with all inks and are the best and most popular blades available today.

Baseboards and Printing Presses

The basic hinge and board combination is still used widely although the vacuum printing table or press is very useful and indispensible for work which requires tight registration. There is a tendency for paper to adhere, due to the ink, to the underside of the printing screen when using a simple hinged baseboard.

The vacuum press has enabled the printmaker to print serigraphs of increasingly high quality and eliminates the paper-screen adhering problem. A vacuum table very simply consists of a vacuum baseboard which is switched so that the vacuum is released when the screen is raised - when it is lowered the vacuum comes into effect and holds the paper in registration. A counterbalanced squeegee arm on a bearing runner is attached to the hinging devise. The factory produced presses available today are precision engineered and of very high quality. There are also presses being manufactured today which are geared for mass production and are semi or fully automatic.

Stencil Techniques

Serigraphy, as already stated, is essentially a stencil method of printing -

it is the blocked-out negative areas which do not print. The materials and characteristics of the stencil mediums has developed to the point where an extremely wide range of print marks and results are obtainable.

Liquid Block-Out Solutions

Apart from the traditional block-out mediums such as glue and shellac there are now many advanced fillers available. These are mostly water based and can be applied to the screen in any manner to obtain many different textures and effects. They have improved covering characteristics and flexibility and are durable during long print runs. There are also fillers which dry very rapidly which are ideal for quick repairs. Water based block-out solutions cannot be used with water-based inks - for this application a lacquer or oil based filler is used. Lacquer based fillers can be used with oil, water, enamel and cellulose inks but not with vinyl inks.

There are many positive stencil or reversal techniques in common use today. These have developed to enable an artist to work in the screenprint medium in a direct manner - the image he works onto the screen fabric is the one that prints.

Basic Glue or Shellac Technique

A preliminary drawing can be made on the screen or one can work free and directly. Glue is used to paint the image onto the screen. When the glue has dried shellac is squeezed over the whole surface. Once dry the glue is washed out with water leaving a positive stencil. The new water based fillers can also be used in place of glue.

Water Based Block-out/Lacquer Method

The procedure is the same reversal technique except water based blockout or glue is used to create the image and a lacquer blockout is screened across after it is dry. The positively worked image is washed out as before.

Tusche, Litho Crayon Technique

Liquid tusche, a black ink mixture of wax, soap, shellac and black pigment is used to work directly onto the screen. The fluidity of the tusche ink allows for great freedom and painterly effects. Lithographic crayons can also be used as a drawing medium either on their own or in conjunction with tusche. After drawing or painting the image the screen is squeegeed with water soluble blockout solution. The blockout is modified to a mixture consisting of : 4 parts blockout, 2-3 parts water and 5 drops of Phosphoric, Hydrochloric or glacial acid. The acid in the mixture helps to harden the tusche or crayon making it easier to wash out. The washout is done with turpentine, mineral spirits or lacquer thinners by rubbing both sides of the screen with solvent and cotton waste. Before printing the resultant stencil should always be checked for pin-holes in the stencil areas.

Maskoid or Liquid Frisket Applications

Maskoid and Liquid Frisket are synthetic latex based solutions. They can be applied in a similr method to tusche directly to the screen. A water based blockout is again squeegeed over the screen. The Frisket or Maskoid, when the screen filler is dry, is simply rubbed off the screen by hand or with an

Paper Stencils

These are used quite extensively for short run printing. They were the original indirect stencils. The best paper for stencil purposes is tracing paper or layout pad paper which are not too absorbent. The thickness of the paper used determines the density of the ink deposited through the screen. The paper stencil is placed under the screen in place and adheres by the ink, during the first pull of the squeegee. It is possible to tape the outer edges of the stencil in the non-printing areas to the screen as an added precaution.

Cut Film Stencils

It is in this field and photographic stencils that the biggest advances have occurred in recent years. All the cut-film stencils work on the same negative stencil principle as straight paper stencils. Basically they consist of a lacquer or water based film laminated to a paper or plastic backing. The film is cut with a sharp cutting knife so that the film layer is cut through but not the backing sheet. The printing areas are peeled away from the clear backing.

The cut-films are adhered to the screen (which must be carefully degreased), by either water or adhering fluid depending on the type of film being used. The procedure of adhering normally revolves around dampening the film through the screen and then blotting dry with medium pressure to adhere the softened emulsion. When the stencil is dry the backing strip is removed carefully. Both water-based and lacquer based cut-film stencils are available for use with different inks.

Photographic Stencils

It is largely due to research and discoveries in the commercial field of photo-screenprinting that rapid and highly sophisticated advances have taken place in recent years. The development of various photo-stencils has pushed screen printing into further exploration of inks, meshes, printing presses and related equipment. These explorations and findings in the industrial world are of direct advantage to fine art applications. Most contemporary print studios are equipped with facilities for photo-mechanical and related techniques. This is due to the popularity and potential of photographically related and derived imagery in our time.

The photo-stencil is basically a light sensitive coating that hardens when exposed to ultra-violet light. The coating can be either applied directly to the screen or it can be on a temporary support and is later adhered to the screen.

The light sensitive coating or emulsion is exposed through a positive (either a photographic positive on orthochromatic line film or a hand drawn positive on acetate) and where the u.v. light is blocked the emulsion remains soft and is later washed or developed out leaving the hardened stencil.

Direct Stencils

Direct stencils are made from colloidal solutions which are light activated by the addition of bichromates or diazos. The colloid is made of gelatin, glue or albumen and recently from improved synthetics such as polyvinyl alcohol and polyvinyl acetate. It is this solution which is soluble when not

exposed to light.

Monofilament polyester and nylon are the most suitable meshes for direct photo stencils. They should have high mesh counts for good adhesion and detail. The mesh fabric must be thoroughly degreased and 'prepped' to ensure perfect stencil adhesion. The screen should then be allowed to dry completely in a dust free environment.

Direct emulsions come in two parts - the colloid and the sensitizer. These are added according to recommended proportions and time. The solutions are applied in yellow or red safe light conditions using a trough and squeegee, camel hair brush or scoop-coater. Five or more coats are normally applied as evenly as possible and at right angles to each other. The quality of stencil is directly related to how well the emulsion covers the interstices of the mesh.

Exposure is carried out with the screen and positive contacted together - preferably in a contact printing vacuum down-frame. The light source should be of the ultra violet spectrum - carbon arc, black light, zenon, cool fluorescent or photo-flood. The exposure time depends on the sensitivity of the emulsion, the thickness, the strength of the exposure light and the distance of the screen from the light source.

The screen is, after exposure, washed out with cold or warm water and a fine spray until the image clears and detail becomes visible. It should then be horizontally fan dried.

Indirect Stencils

These presensitized films are processed away from the screen and adhered at a later stage. They are composed of a thin layer of emulsion adhered to a transparent polyester or vinyl backing sheet. They facilitate excellent mesh bridging and detail.

Most of the pre-sensitized films require exposure, development in a hydrogen peroxide solution and washout. The most recently developed direct emulsion stencils only require exposure and washout in water. The films such as Ulano Hi Fi Green, Hi Fi Blue, Colonial Five Star and Autostar are all exposed through the backing sheet. The preparation of the screen and exposure is the same as for the direct stencil method.

Adhesion of the developed or washed out stencil is carried out on a flat, smooth surface. The stencil is placed emulsion side up, the prepared screen is lowered over it and excess water blotted off with newsprint or similar and slight pressure with a roller. Adhered areas appear darker. The screen is then fan dried before removing the plastic backing sheet (carefully peeling from a corner) leaving the photo stencil on the screen.

CHAPTER FIVE

ALTERNATE PRINTMAKING AND EXPANDED TECHNIQUES

The graphic arts have always proved to be very flexible. This ability to change, coupled with the challenge presented by technology, has led to innovations within the graphic art and print field. Expanded techniques have developed which, unlike the ones which have become an indespensible part of the art 'vocabulary', cannot be easily catagorised. Hybrids have emerged along with totally new methods for creating prints. In the ongoing search for new means of expression previous boundaries and limitations have been ignored.

The Monoprint or Monotype

The monoprint or monotype is a unique print or proof printed from a flat surface on which the image has been painted or applied by other means.

Virtually any non-absorbent flat surface can be used for the initial image. Glass has been quite extensively used for a long time but lucite, formica, perspex, masonite or metal can also be used. The image can be applied by many means such as by brush, rags, sponges, rollers, cardboard and wooden sticks. The possibilities vary from surface rolling ink through stencils and drawing into it with a sharp tool to a free painterly approach where the oil colour is painted on directly and turpentine added to obtain blended effects. Oil based colours are usually employed for monoprints because they don't dry very fast - allowing time to work into the plate before printing.

The printing of a monotype is also flexible in that one can experiment with different types of paper and means of printing. A fairly absorbent paper is often used. The paper is lowered onto the print and the reverse rolled over with a hard printing roller or the plate and paper can be sent through a press. Etching and letter-presses can be used to transfer the print. If an etching press is used the pressure must be considerably less than for intaglio applications. It is also useful to slightly dampen the paper when printing a monoprint on a press. A print can also be obtained by lowering the paper onto the inked surface and drawing on the reverse side with a variety of sharp instruments to off-set the image onto the paper.

The monoprint is a unique image and cannot be duplicated because it is not possible to re-ink the plate exactly as before for each print. A consistent edition is therefore not possible and the monoprint has for this reason often been excluded from graphic print exhibitions.

Both Degas and Gauguin were early pioneers of this medium. They exploited the spontaneity necessary in this medium as well as the incredible colour possibilities. Degas made over three hundred monoprints often reworking them in oil pastels. He was an innovator in virtually all the potentials of the medium and even developed a transfer paper with which one could transfer the monoprint to a litho stone and thereby print a consistent edition. The monoprint has recently been 're-discovered' by contemporary artists and given a new impetus. Milton Avery and Mark Tobey have done some radically experimental monoprints. Jim Dine has combined drypoint with monoprint. Gabor Peterdi has experimented extensively with combined techniques and multiple plate printing.

The Collagraph

The collagraph (or 'collograph') is a print taken from a plate which is built up from a variety of collage materials, inked, wiped and printed under pressure.

The collagraph is one of the newest and most innovative printmaking techniques being explored today. The range of tonal and textural possibilities is infinite. The collagraph has its early roots in the late 1950's and early 1960's with the advent of permanent glues such as epoxy resins, polyesters, acrylics and other plastics. These new technological discoveries, opened innumerable doors. The word 'collagraph' was coined by Glen Alps in an attempt to find a word which described the technique. The collagraph is also indebted to early collage and assemblage experiments by French artists such as Picasso, Braque, Matisse and Gris who helped free the restrictions of material and imagery. Rolf Nesch was one of the earliest artists to experiment with assembled printing plates. These plates were almost entirely metal and he manipulated them by welding, brazing and soldering. It is from these roots, coupled with experiments done with cardboard and metal relief prints, that the collagraph has evolved.

The collagraph is printed as an intaglio plate although it can be combined with relief inking techniques. It is essentially an additive process in that the parts are constructed rather than 'removed' as in intaglio etching. Any firm, reasonably thin board can be used for the initial collagraph base plate. Masonite, perspex, plywood or metal plates can be used. If the plate is absorbent it must first be sealed with an acrylic medium. The edges as with an etching plate, should be bevelled.

The materials that can be used to build up the image on the plate are endless. The only real limitation is the height of the various materials. Areas should not be constructed higher than about one centimeter from the base matrix if the collagraph is to be printed on a normal etching press as this could damage the rollers, blankets and bearings. The variety of materials that can be used include lace, string, sacking, wire, gauze, washers, gaskets, coins, card, papers, aluminium foil, sandpaper, sawdust, gravel, foam, leaves and various adhesive tapes. All elements of the image must be well glued to the plate and sealed with an acrylic varnish or lacquer spray medium to enable them to be inked and cleaned easily.

Textures and granular particles can be impressed into acrylic gesso polymer, or similar pastes to create further effects and tonalities. Prior experimentation in the variety of obtainable effects is often necessary and beneficial as a reference.

The inking of a collagraph is intaglio but can be combined with relief surface rolling. The plate is covered with a layer of oil based etching ink. This can be carried out using small card squares and squeegeeing the ink over the surface. The ink can also be applied to certain areas with a stiff stencil brush or a strip of felt tightly rolled and taped. The ink must be worked well into the various parts of the image before wiping. The excess ink is then removed using new strips of card and/or tarletan folded into a wiping pad. This can be followed by hand wiping as is the practice for etching. If any areas are to be relief inked it is carried out after the intaglio wipe. It is also possible to ink collagraph plates using the 'multilevel viscosity method'.

A good quality etching paper is usually used for printing and is prepared in the same way as for other intaglio processes - soaking and blotting. Press pressure is determined by test runs of the collagraph plate through the press. When using an etching press extra cushioning is necessary in the form of a foam rubber blanket of approximately two centimeters with a thick felt blanket as a second blanket. Pressure should be adjusted slowly.

Prints should be dried between blotters under a medium weight such as a piece of heavy masonite or chipboard to avoid loss of embossment.

Consistent colour collagraphs are obtainable by using separate plates, for each colour, printed in register. Stencil inking of various parts of the plates is also possible. A colour collagraph print can also be achieved by printing the various parts of the image in the appropriate colour as the plate is assembled or constructed.

After printing the plate is cleaned using turpentine or other mild solvent. Lacquer thinner, acetone and other strong solvents should not be used as they can damage the protective sealent and attack the glue used for construction.

Sculptural and Three Dimensional Prints

Elements of dimensionality have always existed in the print - the actual ink deposit of an etching or screenprint is raised on the surface of the paper and the Japanese Ukiyo-e masters used blind and colour embossing in their Eighteenth Century prints. Today though, dimension has entered the print arena in more forceful ways to continue the persuit of new expressive means and continue to challenge print criteria. It is inevitable that the question

of when does a print cease to be print and become a sculpture or multiple must arise. There is no longer a hard and fast definition of what constitutes a print. Expanded printmaking utilizing new technology and materials has widened even dimentional parameters.

Uninked Embossing, Blind Printing or Gauffrage

The resultant prints made from uninked deeply bitten intaglio or relief plates, under pressure, produce a type of paper bas-relief. This technique is referred to as blind-printing, uninked embossing or gauffrage. A dampened, heavy, good quality pure rag pulp paper such as Murilla, Arches 300, Arches Cover and Rives BFK is used with an etching press. This yields a very accurate impression in relief on the paper. Additional hand burnishing can be employed to ensure that the paper has retained all the detail. The print must be carefully and slowly dried so that it is not damaged by shrinkage. Hydraulic and vacuum presses that can exert extreme vertical pressure can also be used for embossing.

The Cast-Paper Print

The cast-paper print has developed out of the embossed print, the collagraph and an interest in the physical qualities and components of paper. With the increase of the importance of paper as the print artists matrix an interest has evolved in its creative process. Many artists are now experimenting with their own papermaking and have found that it has many exciting intrinsic qualities. Paper and paper-pulp or fibre can be manipulated in many ways and has become a unique and sensitive medium. Contemporary artists such as David Hockney and Robert Ranchenberg have done innovative work in this medium often

collaborating with papermakers at their mills.

Various mould techniques for relief paper casting have been experimented with. Latex or a new rubber-like plastic compound called R.T.V. (which has a zero shrinkage factor) are being used and are especially useful when making moulds with fine detail and undercutting. Plaster of Paris is also used quite successfully for moulds. The moulds are often sprayed with an aerosol silicone spray which acts as a release agent.

The paper pulp, which should be the consistency of cottage cheese, is placed in the mould forcing it into all parts. Excess water is blotted up. Drying must be slow and controlled. Coloured pigments, textured paper, string and other collage elements can be added during moulding.

Acrylic glass or perspex stencils have also been used in a grid manner to enable pigmented paper pulp to be placed in the same place for each print. After the pulp is placed in the required areas the stencil is removed and the paper pulp is run through a press (an etching press or letter-press are suitable) fusing the fibres into a continuous paper print. In this type of print the colour is an integral part of the moulded paper.

Vacuum Forming and Plastics

The dimensional print has further developed by the adoption of the commercial vacuum-forming machine as a means of obtaining a three-dimensional surface. The method is simple and can produce unique and impressive effects otherwise unobtainable. The vacuum forming machine is used industrially to form thin plastic mouldings for packaging of sweets, cosmetics and other products.

The process involves placing a heated thermoplastic sheet over the mould or object in a vacuum chamber. The air in the chamber is then drawn out by a compressor forcing the plastic to conform to the shape of the object underneath. When cool, the plastic is released from the mould and retains the reproduced shape.

Many small commercial vacuum forming machines are available using mostly infrared bulbs to heat the plastic before forming. Thermoplastics most often used in this process are acrylic styrene butyrate and acetates. These plastics have the advantage over thermosetting plastics in that they can be reheated, softened and reshaped if desired.

The surface of the plastic sheets is normally printed or manipulated with heat-resistant acrylic inks prior to forming. This is easily done by screen printing or off-set lithography enabling uniform edition printing and fine detail reproduction. The prints can also be worked after forming.

Plastics as we know them today include a wide range of materials made up of combinations of carbon, oxygen, hydrogen, chlorine, fluorine and nitrogen. Acrylic plastics in sheet form such as Perspex or Plexiglass have a great potential due to their having very similar characteristics to wood - ease of cutting and working. Acrylic sheeting can be screened, painted, printed and air brushed. Robert Rauchenberg and Larry Rivers have both screenprinted onto acrylic glass with striking effect. There are also many chemical curing and thermal setting techniques in employ. These compounds are applied by hand in various liquid forms to make moulds and three dimensional forms.

Acrylic plastics available in reflective transparent, translucent and

fluorescent colours have enabled prints to further expand into kinetic and light fields. Metalized surfaces, mirrors and other distorted surfaces can be used to contrast and interact to create optical effects and movement. Fluorescent and pearlescent printing inks have further activated new images and planes.

Assemblages and the Assembled Print

The print today is often combined with other media to further dissolve the traditional parameters between print, sculpture and multiples. Wherever there is an element of print integrated in a work there will be an argument for it as a print. Every work has to be governed by its own rules which it establishes for itself, and work within these restraints.

The assembled print or multiple probably owes much to commercial package and container design. Screenprinting and lithography are used to print the surfaces flat prior to assembling. Both these mediums can also print on a wide variety of materials.

The assembled print is most often constructed by first printing the paper or other surface and then cutting, folding and further working it to construct the predetermined graphic. There are many examples of this type of work. Andy Warhol was an early Pop propegator with his outsize, Ajax Boses which were essentially assembled prints. Red Grooms has printed two lithographs which were cut and assembled to form a three dimensional print 'Gertrude' which was framed in a perspex box. Claire Falkenstein has made a dimensional graphic by printing intaglio plates onto black paper and then assembling them by sewing them together. Even further removed Ed Keinholzs' "Sawdy" - a car

door with a mirrored window which rolls down to reveal a screenprinted scene.

Many artists have been tempted to add collage elements to their prints. A wide variety of objects and pre-printed elements have been included in works. Joe Tilsen and John Heartfield are pioneers in this field. One artist, Dieter Roth, went so far as attaching a banana to his print intending it to decay!

The Soft Print

Fabric has recently been rediscovered as a matrix on which to print. Textiles have been printed from very early times but mostly for the sake of pure decoration. During the French and American Revolutions mythological scenes and political events were reproduced on fabric by copper plate engraving but this practice soon died out. Today fabrics are being printed on by a variety of methods and manipulated to create two and three-dimensional works. Material has the potential to be stuffed, stitched, embroidered, quilted and combined with many other mediums after printing.

For most of the traditional print mediums fabric can be treated much as one would paper. It is with the manipulation and characteristic of the particular fabric that the medium comes into its own right.

Photosensitive emulsions are available for coating fabrics. These are usually obtainable for either contact printing applications or enlarger photo-projection. Photosensitive gums are also available which enable one to dye them and so create image and colour simultaneously. Xerox iron-on transfers can also be employed. Many hand colouring crayons, dyes and pens

are now also available for textile use.

Robert Rausehenberg in his "Hoarfrost Editions" used collage and transfer by off-setting printed images onto the cloth. The fabrics, cheesecloth, satin and silk, were then fastened to various backings! Annette Bird has made "Pattern for a Soft Waterfall" - a colour etching on fabric which is a two dimensional work in one state but can also be cut out, quilted and filled to form the three-dimensional waterfall. Many other artists have in recent years explored the many soft-print possibilities with striking effect.

The Outsize or Oversize Print

The print has since the 1960's expanded in dimension along with its other possibilities. Today there is nothing especially unusual about a one to two metre print. There is no reason why a print cannot be as large as a painting or bigger. The artist must, though, have the vision and energy to vitally activate the area. Some artist have made outsize prints merely to try to overwhelm the spectator by sheer dimension.

Some of the artist who have in recent years worked in this idiom are Roy Lichtenstein, Robert Rauschenberg, Helen Frankenthaler, Jasper Johns, Frank Stella and Andy Warhol and Philip Pearlstein. The two most common print mediums for extra large prints are off-set lithography and serigraphy. Rauschenberg has made a print entitled "Currents" which measures two meters by eighteen meters and consists of photo-screenprints of newspaper collages organized in a grid structure. This print, as with most large prints, aspires to be larger than paintings. "Currents" is larger than even the average monumental painting and executed successfully in a simple print

medium.

Prints are now reaching billboard size along with mural painting counterparts. A computerized full colour printer has been developed by 3 M which will now print to enormous proportions. The machine starts with a 35 mm negative, scans it and colour separates the film. The computer then determines scale and colour balance before printing in the process colours.

Printmaking and Photography

The use of photography for printmaking was employed as early as 1829. Niepce developed a light sensitive coating for intaglio plates. He called the process the 'heliograph' and it consisted of waxing a print of the engraving or drawing to make it transparent, placing it over a zinc plate covered with a light sensitive ground of bitumen of judea and exposing it to sunlight. The exposed bitumen hardened and the parts which were covered by ink of the drawing washed away. These parts were then etched. Similar methods were used to transfer images to relief wood blocks.

This was a camera-less use of photography as was the photomontage, photogram and cliche verre. The photogram was invented in 1835 by Fox Talbot who lay lace on photographic paper, exposed and developed it. In the 1920's Man Ray and Moholy-Nagy reinvented the photogram.

The cliche verre process was invented by William Havall in about 1836. An opaque coating was applied to a piece of glass. This was then drawn through to create a negative image which was then used to expose photographic paper through. A print was thus obtained of the drawing. This process has also

been referred to as "heliographic sur verre" and "glassprints". In the 1850's the artists of the Barbizon School discovered that this process could be freely and spontaneously adapted to their use. Rousseau, Millet, Delecroix and Corot experimented with this process.

Cliche Verre is one of the earliest examples of a printing process derived from photographic principles and completely manipulated by the artist. Artists have recently produced colour cliche verre prints using gum dichromate processes. This works by means of a light sensitive solution consisting of gum arabic, ammonium dichromate, water and a pigment. The solution is coated onto paper, dried in the dark and exposed through a negative. The unexposed areas wash off leaving a permanent image.

It was though in 1857 when Poitevin patented a bichromated albumen coating that photography and the print started a lasting relationship. This coupled with new mechanical printing processes during the 1860's threatened the 'reproduction artist' who made copies of originals for publication. By the 1880's he was redundant. The artist has, because of the mass production mechanics and chemistry, viewed photography with suspicion for a long time. The camera has been viewed as a threat to the creative role of an artist as recorder and reproducer up until quite recently.

Photography has developed over the years and experimentation has taken place in its field much the same as in the growth of printmaking. It was inevitable that certain developments would influence the artist. Maholy Nagy and Man Ray were pioneers in the use of photography for freer artistic expression. They created stroboscopic exposures, photomontages and photosuperimpositions. Artists slowly realized that as in any medium,

perception is the essence and photography was merely another means of exploring it. Despite the negative attitude of the early printmaker photography has reached acceptance as an art form and continues to expand the dimensions of contemporary printmaking.

Photography introduces a visual language which can be mixed and set-off by other techniques with endless possibilities. The artist has benefitted from photographic advances in the commercial fields of photo lithography and photo silkscreen which have been passed on to the printmaker. The relationship has grown to extend the scope available to the artist.

Electrophotographics and Xerography

New ways of visual expression are perpetually being sought and this has led to a large field of image making means being considered. The photo-copier is being increasingly recognized for its artistic potential. It is an exciting printmaking tool of our time. Black and white Xerox and photo-copy machines work on the principles of electrophotography.

Electrophotography makes use of photoconductive substances that decrease in resistance when exposed to light. These semiconductors conduct electricity when exposed to light, but are insulators when in the dark. They are applied to a conducting drum whose surface is electrostatically charged in the dark and then has light projected onto it in the shape of the image to be copied. The areas which were not exposed to light retain a residual charge which is then dusted with a thermoplastic resin powder. Paper is then placed on this image which is transferred by an electrical charge to the paper and permanently adhered by heat.

Many artists have recently started to view the copy machine as one would a printing press. This is in principle exactly what it is - a reproducing machine. Much depends on how the copy machine is used and manipulated. Prints have been created in many ways such as photomontage, collage and placing three dimensional objects on the exposure window. Prints can be run through many times to reduce tonal values and highlight linear effects. The modern copy-machine will print on virtually any paper and this has enabled adventurous printmakers to print editions on 100% rag papers such as Arches and Reeves.

Colour copiers open up a whole new realm of possibilities with full colour and unlimited variations. These machines such as the Xerox 6500 Colour Copier, 3M Colour in Colour and the Itek work on similar principles to the black and white copiers but use dye transfer of the three process colours - magenta, cyan and yellow. The colour transfer is worked out by means of separating filters. Possibilities are endless through manipulation of the colour settings. It is also possible to intervene in the printing process before the heat fixing operation to further work the image. The print can also be run through the machine a number of times to obtain unique results.

The 3M 'Colour in Colour' system can also print from colour transparencies and has enlarging and reducing capabilities. Prints can also be made on a transfer matrix enabling the resulting image to be transferred to a variety of other surfaces.

Computer Graphics

Electronic digital computers have been mass produced for about 25 years. The

terms 'computer graphics' and 'computer art' have been around for approximately 10 years. Computer generated design has in this time proliferated incredibly. Computers with a graphic output came about due to a need for a machine which was capable of showing results graphically in our 'visual age'. This has led to the development of aesthetic computer art and graphics - utilizing instruments that were intially invented without artistic considerations. The facilities for visual output have grown and are still growing exceedingly fast.

Computer art today encompasses many art forms - graphics, films, sculpture, choreography, poetry and music. There has been much surprise and resistance of artistic products of the computer but it is important to remember that progress and evolution are closely related to technological change. Music has from early times been linked with mechanization although simple instruments are available. There are no limitations revolving around music and machines. Mechanization has produced the more sophisticated instruments and music right up to full automation of the synthesizer.

Mathematically conceived forms have ancient roots such as ornaments whose geometric shapes, repitition and symmetry follow mathematically formulated rules. There have been many investigations into aesthetic structures in mathematical forms by artists such as Leonardo da Vinci and Dürer. Piet Mondrian, Le Corbusier and Vasarely have explored harmony relationships. The Constructivists and de Stijl movements used mathematical relations and proportions and Klaus Basset and Herman Stiegler have explored permutations for aesthetic ends. It has been suggested that these roots are natural ancestors of computer graphics.

The first aesthetic graphics from large digital computers were made in 1963 when the magazine Computers and Automation held a competition for computer graphics where selection was based purely on aesthetic considerations. Freider Nake, Georg Nees and Michael Noll were early pioneers of complex graphics which were purely digital.

In 1960 the Boeing Company started to employ computers to simulate possible movements of a pilot in his cockpit. This was the start of the figurative computer graphic. William A. Fetter was the pioneer in this field and also coined the term 'computer graphic'. This figurative use of the computer was for a utilitarian purpose as was the use of the early printmaking mediums.

During the Sixties a significant breakthrough in computer programming techniques created an extension which enabled computers to read-out visually on a television screen. A process developed that enabled one to draw directly on the face of a cathode-ray tube or T.V. screen with a stylus. This significantly reduced the need for certain elementary mathematical and technical programming knowledge which had previously governed access to computer generated design. This, coupled with the incredible retention capacity of a computer memory has enabled virtually anyone to draw his input into the computer without programming language know-how. Knowledge of processes and programs can though, increase possible artistic applications in computer graphics.

Artists have in recent years begun to explore more and more the creative potential of this medium. Computer generated art has many applications in other graphic related fields such as film, television, animation and graphic layout. It is gaining acceptability as an art form and computer graphics

have been exhibited at the Venice Biennale and many other exhibitions. It has been said that the precision reached by computer art brings it close to classical music which is based on highly complex order structures. Questions and evaluations revolving around new instrumental techniques always exist. Computer generated graphics have spurred an unparalleled interaction between art and technology.

TOWARD A NEW PRINT AESTHETIC?

"The print is changing in its technology and therefore in its expressive power."[1]

The print has enjoyed a hyperactive development in recent years and undergone many mutations. Printmaking is the prodigious medium of the late Twentieth Century. Few artists have been able to resist the temptation to explore this flexible medium. The artist's ability to expand and aptitude to revolutionize the medium has led to hybrids of old and new technologies. Dedication to expression has led to a natural innovation in print aesthetics. Today a print can be made by virtually any method an artist desires to use. More artists are working in expanded idioms than ever before. New prints, accepting the challenge of advanced technology, are utilizing multi-dimensions, unlimited editions, soft surfaces, uninked plates and many other techniques to continue to challenge traditional aesthetics of fine art graphics.

We are, like those in the Sixteenth Century, taking an expansive view to try and relate a mass of information and techniques to our needs. Little remains sacred in the renaissance of the graphic arts today. There is, though, no reason to use new technologies and materials unless an understanding of them and their potential is gained. The medium must be suited to an artist's concept and work within its own set of rules without being an excuse for lack of imagination.

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[1] Ross, J. The Complete Printmaker, p.viii.

Romano, C.

Each new discovery has its own intrinsic qualities and each artist his own concerns. The creative function should not be sacrificed to technical innovation and the and the print should never become subservient to technology.

The definition of the print is in a constant state of flux. The very growth which characterises the prints development has confused the issue of what physically constitutes a print. We have no longer only the flat traditional inked image on paper. We have incredible exciting extensions and hybrids at our disposal. The fact that these possibilities are available, and that the medium has been expanded virtually out of all recognition, does not necessarily mean that it has been taken full advantage of. Artists have often been intimidated by defenders trying to force a definition of what constitutes 'an original print' on works. Artists must accept that the print is in a continual state of evolution and use its expanded possibilities and inherent qualities to articulate aspects of their aesthetic. Definitions, by nature, are hard for any medium to tolerate.

"Printmaking should never signify a contraction, a closing down, an involvement withnarrow technical problems ..., it should mean an exposure to new experience, a chance of expansion into a world without frontiers."[1]

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[1] Rothenstein, M. Frontiers of Printmaking, P 13.

GLOSSARY

AIRBRUSH	Small hand held spray-gun used for spray effects on all surfaces.
AQUATINT	An intaglio etching process used to create a range of tone.
BASEBOARD	The matrix upon which the paper is fixed or positioned for screenprinting.
BITE	The action of acid in an etching bath on a metal plate.
BITUMEN OF JUDEA	Asphaltum varnish
BLANKET	Pressed or woven wool felts used on an etching press.
BLOCK	General term used for a printing plate in relief printmaking.
BLOCKOUT	Any material applied to a plate, block, stone or screen to prevent areas accepting ink.
BURR	The ridges of metal formed by the cutting action of a drypoint needle.
CARBORUNDUM	Solid or powdered abrasive (silicon carbide).
CLICHE VERRE	Photographic glass print.
COLLAGRAPH	Intaglio print made from built up collaged plate.
DRYPOINT	An intaglio technique using a sharp tool to draw into a plate. No acid is used in process.
EDITION	Set of identical prints, usually numbered and signed, printed of a work.
EMULSION	Mixture of two incompatible liquids.
FRENCH CHALK	Talc.
GAUFFRAGE	French term for embossed print.
GESSO	Mixture of gypsum and glue.

GROUND	Acid resistant coating used to protect non-image areas to expose plate to action of acid.
GUM ARABIC	Natural gum produced by acacid tree.
HYGROSCOPIC	Water retentive.
LETTERPRESS	Commercial relief printing.
MEZZOTINT	Type of intaglio printing.
MORDANT	An acid.
OFFSET	Method of printing that involves the transfer of an inked image to another surface via an intermediary surface.
PLANOGRAPHY	Printing from a flat surface which has printing and non-printing areas on the same plane.
PROOF	Trial preliminary print.
PULL	To make a print.
RAG PAPER	Pure cotton fibre paper.
REGISTRATION	Correct allignment of colours in multi-colour printmaking.
RESIST	Any material applied to prevent action of light or water.
ROSIN	Organic resin substance that melts when heated. Used for aquatint.
SIZING	Gelatinous substance used in papermaking.
SHELLAC	Type of varnish.
STOP-OUT	Varnish which prevents acid from biting areas.
TARLATAN	Pure cotton fabric used for intaglio wiping.
TUSCHE	Grease based drawing ink for lithographic and silkscreen use.
UNDERCUTTING	In etching or aquatint, the lateral biting of acid under grounded areas.
VEHICLE	Liquid ingredient of an ink which carries the pigment.
VISCOSITY	The resistance in an ink to flour (thickness).

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