Screenprint

Introduction

Screenprinting is said to originate in China where a system of stenciling was devised that used fine strands of hair to hold the stencil image in place. But the process we know now, really took off in the latter half of the 20th century when the technology became available to produce sophisticated imagery photographically onto a screen. The process has of course been widely used in industry, particularly in the printing of textiles. Recently, improvements in ink technology and the introduction of water based screenprinting ink has meant that screenprinting has become more accessible and much less toxic to use.

What sets screenprint apart is its versatility. If the surface is relatively flat it can be printed upon and the fact that no pressure or form of press is used, allows for more or less any material to be printed over. This means that screenprint is ideal for multi-media work where a variety of surfaces may need to be printed over, as well as the finely layered prints most often associated with this kind of printmaking.

Screen Maintenance and Preparation

It is of the utmost importance that screen frames are looked after and that they are always cleaned after use. Keep frames in a place where they are least likely to be damaged.

Screens are very tightly stretched so are easily punctured through carelessness or misuse. They will often deteriorate quickly if punctured, in the same manner as nylon tights develop ladders from holes.

Before starting always check the screen for blockages in the mesh because any dried inks or residue will show in future prints. (If blockages are found it may be necessary to clean the screen with a jet wash pressure hose.) To check the screen, hold it to the light to see whether marks on the surface are actually blocking the mesh or simply a stain or ghost image from the last print. Ghost images are common to used screens but do not in themselves present a problem. They may however be a distraction and can be removed using Pregan Paste to bleach them off. Pregan paste is also used to degrease screens. This will rarely need to be carried out however except when a screen is new and has never been used before.

Pregan Paste is caustic so always wear rubber gloves, apron and eye protection when using it.

To de-ghost or degrease a screen:

1. Place the screen in the wash out unit and brush the screen both sides with the paste.
2. Allow the screen to stand for 30-45 minutes.
3. Gently wash both sides of the screen under running water. Make sure all paste has been washed off.
4. Pressure wash the screen both sides.
5. Allow it to dry thoroughly.

Pregan paste may also be used to clean stubborn blockages in old screens.

**Screens**

Screen mesh comes in different densities. A fine mesh will have smaller holes and therefore allow for more detail whereas a coarser mesh will not have so much detail but will lay down more ink.

- A 120 mesh count (coloured orange or yellow) will most often be used for fine art printmaking where much detail is needed and the images are printed on paper.
- A 90 mesh count (coloured white) will most often be used for textile printing where a greater amount of ink is needed to cover textured surfaces.

**Stencils**

Stencils may be prepared using photo-sensitive emulsion, hand-cut paper shapes or liquid screen block directly applied to the mesh. Each of these processes will yield particular results, but all must be applied to the screen leaving a border of 1 - 2 inches between the edges of the image and the frame. This will ensure that the printing process is not impeded by close proximity to the frame, and that areas that may be blocked by glue are not used in the image.

**Paper Stencils**

Using paper stencils to mask out areas of the screen is one of the simplest forms of screen-printing. Any paper that will cling to the under side of the screen is good to use but a medium weight cartridge paper has been found to be robust and highly effective. Cartridge paper should give a run of up to about thirty prints until the stencil starts to degrade. Paper stencils can be used as a process in itself or as a quick way to get broad background colours.

*To make a hand cut paper stencil:*

1. If you are planning to use multiple layers it is important to think hard about each of these stages. A screenprint will generally be printed so that the first area is the most inclusive. Subsequent layers will cover over the ones underneath, gradually building up areas of opaque colour or tone until the entire image has been assembled.

2. Using a master drawing, trace or photocopy a number copies onto cartridge paper.
3. Cut each stencil with a scalpel and remove areas intended for printing.

4. Beginning with the first stencil (the most open for background areas) carefully layer the pieces down on top of some paper. Take the screen and gently lower it over the stencil. It should be possible to see the stencil behind the screen.

5. Use masking tape to adhere the paper stencil to the screen mesh.

6. Because the stencil is essentially temporary it is recommended that as many prints are taken as possible. Paper stencils cannot be left on the screen as the act of washing the mesh will inevitably remove the stencil. The screen must be washed after each session to prevent it from being blocked permanently by the acrylic.

7. Once the stencil starts to bleed or cockle it is time to stop. The screen should now be washed and dried in preparation for the next stencil layer.

Screen Block

1. Apply drawing fluid
2. Apply screen block
3. Squeegee screen block
4. Leave screen block to dry
5. Wash out squeegee
6. Dried out screen block
7. Wash out drawing fluid
8. Check fluid is washed out
9. Tape out screen

The use of water based drawing fluid in conjunction with screen blocking medium allows accurate and expressive stencils to be created by hand. This is a simple process and a
Welcome low-tech solution to the difficulty of creating removable but long lasting stencils directly on the screen mesh.

**To apply a hand drawn screen block stencil to the mesh:**

1. Place a drawing beneath the screen to use as a guide or sketch out the design on the screen using a soft pencil.
2. Paint the design directly onto the screen with water-based screen drawing fluid.
3. Allow the screen drawing fluid to dry completely on the screen.
4. Apply a generous amount of screen block in a line at the bottom of the screen.
5. Hold the screen away from the work surface and squeegee the screen block evenly in a thin layer over the design.
6. This can only be done once so must be achieved in one go. A generous amount of screen block is essential to ensure adequate coverage and a firm pressure on the squeegee will result in a thin and even layer on the screen.
7. Wash squeegee with soap and water.
8. Allow the screen block to dry thoroughly on the screen.
9. Wash the screen gently so that the drawing fluid is washed out leaving the screen block stencil in place.
10. Check the screen stencil and leave to dry.
11. Tape up the all other open areas on the screen.

**To remove the stencil:**

1. Place the screen in the wash-out unit and warm with hot water.
2. The stencil can then be removed by washing with soap and water. Use a strong soap such as Mr Muscle and a stiff brush to scrub the stencil away.
3. Finish with the pressure hose to remove stubborn areas.
4. With particularly difficult screens Pregan paste may be applied and left on the screen for 45 - 60 minutes before rinsing and pressure washing. (See Reclaiming a Screen below).

**Photo Stencil**

This is a process of making a stencil that will result in the most accurate and detailed work. It is also the process that requires the most equipment. (Photo sensitive emulsion must be exposed to an artificial ultra-violet light source to succeed so cannot easily be done without specialist equipment).

The production of a good quality positive is the most crucial stage of making a photo stencil as this will determine the quality of the image.
Photo stencil positives can be made in 2 main ways:

1. Hand drawn positives

Drawings can be made in dark pencil, pen and ink, black acrylic, Rotring pen, Chinagraph pencil, litho crayon or photocopy toner. If working in a liquid media, drafting film is necessary to avoid cockling of the positive's surface. If using dry media, tissue paper or tracing paper will yield excellent results. Care must be taken not to make positives too light with the media spread too thinly, as this can mean a drastic reappraisal of exposure times.

2. Digital or photocopy positives

Photocopies or laser prints from a computer are ideal for making a photographic positive. Print outs can be made on acetate, tracing paper or ordinary photocopy paper (90g) that has been oiled with vegetable oil to make it translucent. (Oiled paper positives have the advantage of being cheap and readily available in a range of sizes).

It is important remember that screen stencils are there to either block up holes in the mesh or leave them open. There is nothing in between. An image therefore cannot contain any areas of grey but should be separated into areas of either black or white.
This can easily be achieved by manipulating the image in a computer using Photoshop or adjusting the settings of the laser printer to convert it to half tone dots.

The final image should be printed out at a resolution that is suitable for the screen mesh count (for an orange 120 mesh no finer than 47 lpi resolution). See Digital Positives for more detailed instructions.

If using a photocopier, the effect of copying is usually enough to separate the image. However, if in doubt make a further copy from the first copy to degrade the image and heighten its contrast.

Once the positive has been created, it is necessary to prepare the screen with a light sensitive photopolymer emulsion that will eventually become the stencil.

To prepare the screen with photopolymer emulsion:

1. The coating trough
2. Tip back screen 45 degrees
3. Apply firm pressure
4. Draw trough up smoothly
5. Tip screen back and scoop off
6. Arrange positive centre of screen
7. Expose screen to U.V. light
8. Wash out stencil gently
9. Check stencil

1. Photopolymer emulsion is a light sensitive acrylic based liquid. It is sensitised when first used and will subsequently have a shelf life of about 6 months. Keep the emulsion in its
box, out of direct sunlight with the lid firmly tightened. The emulsion will tolerate low-level light for short periods so it is possible to coat screens in a darkened room rather than a darkroom. Screens should never be prepared or allowed to dry in direct sunlight.

2. Make sure that the screen is clean, dry and free of all blockages.

3. Lay newspaper down as the emulsion may drip.

4. Assemble the coating trough and make sure that it is clean and dry. Pour a generous amount of emulsion into the trough.

5. Hold the screen front side tilted back about 45 degrees. (The front side of the screen is the side of the mesh that is contained within the frame).

6. Start by holding the coating trough against the bottom edge of the screen mesh. Gently but firmly, using a reasonable amount of pressure, draw the coating trough smoothly up the screen without stopping.

7. When the trough is at the top of the screen mesh keep the trough in place while tilting the screen the other way. Remove the coating trough by scooping off. This should ensure that no drips occur. If there are any drips, the reversal of the angle of the screen should mean that they do not drip over it.

8. The screen should be coated with an even layer of emulsion. If the emulsion seems too thick in areas, simply repeat the process without applying any more. That is, scrape the edge of the coating trough up the screen to remove the excess.

9. In industry the screen will be coated on both sides to make a stronger stencil. This is to allow prints to made thousands of times. Usually a single coating is sufficient.

10. When the screen has been coated evenly remove any thicker emulsion that has collected around the edges with a soft spatula.

11. Place the screen in a darkened room to dry.

12. Any remaining emulsion should be replaced back into the container and the coating trough washed thoroughly.

Please note that the coating trough should always be kept clean. If emulsion is allowed to dry on the coating edge it will ruin the coating trough.

To expose the positive to the screen:

1. Like conventional photography, judge the exposure times to suit the image. For very fine work it is possible to reduce the exposure time to eke out more detail. See below for guide to exposure times.

2. If using an oiled photocopy make sure that it is fresh and that it has had any excess oil removed. When exposure is complete the exposure unit glass must be wiped down with soap and water to remove any oily residue.

3. Place the positive image side up on the exposure unit glass.

4. Place the screen gently over the top, positioned so that the image is centred. Care must be taken to prevent the corner of the screen from accidentally hitting the glass.

5. Put the lid of the exposure unit down, activate the vacuum and expose for the correct duration.
<table>
<thead>
<tr>
<th>Type of Positive</th>
<th>Exposure Time</th>
</tr>
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<tbody>
<tr>
<td>Acetate</td>
<td>2 mins</td>
</tr>
<tr>
<td>Drafting film / tracing paper</td>
<td>2 mins</td>
</tr>
<tr>
<td>Oiled copy or laser print</td>
<td>2.5 mins</td>
</tr>
</tbody>
</table>

To process the exposed screen:

1. Place the screen upright in the wash out area.
2. Wet both sides of the mesh.
3. Using a low pressure and a soft sponge start to wash the unexposed emulsion out of the screen.
4. Check the screen periodically by holding the mesh to the light.
5. If needs be, the screen may be subjected to short bursts of high water pressure from a jet hose. Take care not to over do this as too much washing can blast away the stencil whilst it is fresh and relatively soft.
6. When the open areas in the stencil are judged to be completely washed away, rinse the screen thoroughly under running water.
7. Dry the screen.
8. The screen should then be allowed to harden. This may be done by leaving the screen in sunlight for a day or so. Alternatively, put the dry screen back in the exposure unit and expose it to a further 4-5 minutes of ultra violet light. The screen should then be left for at least 2 hours before it is printed.

**Paper**

When using water-based inks the choice of paper can be crucial to the end result. Because water is involved, some papers will tend to buckle and cockle when it is printed on. As a general rule a heavy paper will hold its shape better than a lightweight one. A 300g paper such as Somerset or Bockingford are suitable or a heavy card can also be used.

With mould made papers, be sure to print on the front side. This can be ascertained by examining the water-mark or looking at the deckle around the edge of the paper. The deckle should lie flat when the paper is face up.

**Inks**

Water-based inks are available in many different qualities. The Daler Rowney System 3 screen inks are not the best on the market, but are by far the best value for money and ideal for beginners or students. To mix up the inks use a 50:50 mix of System 3 Acrylic Medium with a good quality acrylic paint.

Unused inks can be stored in airtight containers for future use, but take care not to allow dried or half dried inks to contaminate them as this will lead to blockages.

**Printing**
Before beginning to print with the screen, examine the stencil for holes or defects. These may be spotted in with a little of the photopolymer emulsion. Expose the screen to ultra violet light again to set the spotting out when dry.

Around the edges of the stencil are open areas. These must be taped out with either paper gum-strip or good quality parcel tape. Make sure that the tape is applied to the back of the screen so that it does not impede the movement of the squeegee on the front.

**Preparation:**

Screenprint is notoriously hungry for space so make sure that before you start printing there is enough room for all the things needed:

- inks
- paper
- screen and hinge board
- squeegee
- drying the prints
- bowl of warm soapy water and sponge for washing out
- dry rags for drying washed screens

It is essential that when printing begins everything is organised and to hand as any delays may result in inks drying in the screen and causing blockage.

**To set up registration:**

1. Fix the screen to the vacuum bed or hinge board.

2. Tape a clean acetate sheet, large enough to comfortably hold the image, to the hinge board along one side of the acetate.

3. Print the image directly onto the acetate.

4. Place the paper beneath the acetate and position it.

5. Fold over the acetate sheet so that it is clear of the printing area and take a print onto the paper.

6. For large print runs, tape small cardboard stops to the print bed along 2 sides of the registered paper. These can then be used to register all subsequent prints without the need to consult the acetate master.
To print:

1. When the screen has been prepared and fixed into the vacuum bed or hinge board, raise the screen off the print surface by propping it up with a piece of wood.

2. Spread a line of ink generously along the bottom of the screen a little wider than the image.

3. With the squeegee, gently flood the screen by pushing the ink back so that it covers the screen and fills the mesh evenly. Do not push ink too hard against the mesh as this will result in ink being forced through the mesh and gathering on the other side.

4. Remove the prop and lower the screen over the paper.

5. Hold the squeegee firmly in both hands to ensure an even pressure.

6. Position the squeegee at the far side of the stencil at about 45 degrees and pull it across the screen so that it scrapes tightly over the stencil.

7. Listen to the sound of the squeegee as the sharp edge of the rubber scrapes along the mesh. It is important that this sharp corner edge of the squeegee rubber be the contact point. If the squeegee is pressed too hard the rubber will bow and ink can be forced behind the stencil on the other side of the screen. If this happens it will need to be cleaned and dried before continuing.

8. Once a print has been taken it is good practice to flood the screen immediately afterward in preparation for the next print. This will ensure that the screen is not left with small traces of ink on it. Small amounts of ink will of course dry with greater rapidity than large amounts.

9. Water-based acrylic inks tend to dry much quicker. This can present considerable problems if the atmosphere in the studio is hot and dry. Always be on the look out for blockages caused by dried up ink and have to hand a bowl of soapy water and a sponge with which to clean the screen in situ. To do this, place a pad of newspaper underneath the screen and have a clean rag ready to dry it off with. (The screen can of course be washed down in the wash out area but this would mean a lot more drying and the loss of registration).

Washing

When printing has finished scrape off any spare ink and store for future use in an airtight container. Remove the screen from the vacuum bed or hinge board and wash it down thoroughly in the wash out area.
Used screens must never be left with inks dried into the mesh as acrylic can be extremely difficult to remove.

Reclaiming a Screen

After the print is complete the screen may be reclaimed and used for another print.

To remove paper stencils:

1. Peal off the stencil and throw it away.
2. Wash the inks from the screen with warm soapy water.
3. Clean the stencil off the screen after every session. Do not let the inks dry on the screen.

To remove photo stencils:

When handling chemicals always use a dust mask, eye protection and rubber gloves.

1. The photopolymer emulsion is removed with a chemical stripping solution. This is kept ready diluted (about the strength of orange squash) in a water diffuser in the wash out area.
2. Place the dry screen upright in the washout sink. Spray both sides with the stripping solution and brush it into the stencil with a soft plastic brush.
3. Allow the screen to stand for a few minutes.
4. Do not let the screen stand for too long as the result of letting the stripping solution and the stencil dry out is "lock in". This means that the photopolymer emulsion cannot be removed and the screen mesh must be replaced!
5. After a few minutes use the pressure washer to remove all traces of stencil until the screen is completely free of blockages.

To remove screen block:

1. Place the screen in the wash-out unit and warm with hot water.
2. The stencil can then be cleaned off with soap and water.
3. To do this use a strong form of soap such as powdered Flash dissolved in water. Coat both side of the screen and leave to stand for ten minutes. A stiff brush and hot water will help to scrub the stencil away.
4. Finish with the pressure hose to remove stubborn areas.

Artists

Eduardo Paolozzi
Andy Warhol
Robert Rauschenberg

Further information

Hoskins, Steve, Water-based screenprinting, Printmaking Handbooks, A and C Black.
Fortune, Dave, The Art Teachers Guide to Water based Screen Printing, published by Daler Rowney

Adam, Robert and Robertson, Carol, Screenprinting: The Complete Water-based System