How does a fine art printmaker become interested in what are purportedly decorative processes for domestic tableware production, and what do they have to offer the fine artist?

In both Europe and the United States there has been a rekindled interest in the use of print onto ceramic artefacts. In the UK this has been exemplified by exhibitions such as *Hot off the Press*, curated by Paul Scott. The reasons for this new interest are fundamentally based within the fields of both Art and Design, and are concerned with the reappraisal that all artists are making as new technologies create new opportunities. For ceramicists, this allows the break from the 'form follows function' tradition. For printmakers and other artists, whilst they welcome new opportunities, print on ceramic and enamel is often seen as a more pragmatic and permanent way of producing art for public commission. The combination of ceramic and print also helps prise open the debate for a convergence between the traditional borders of fine art and craft. Is a screenprinted enamel panel produced for the side of a building craft? Or, conversely, is a commercially bought domestic china mug, decorated with a printed transfer commissioned from a printmaker who has no knowledge of making ceramics, following the notions of form following function?

The history of decorated ceramic white ware or tableware is well documented. To place this in context for printmakers, this paper divides into two distinct parts. Firstly, it will cover a short potted history of a few of the available ceramic printing processes, illustrated as much as possible with less perceived yet familiar printed artefacts, and their relation to the development of print processes for ceramics and printed enamel on metal. This will be followed by a general overview of the work
undertaken at the Centre for Fine Print Research at UWE, apart from a major research project into relief printed photo-ceramics, which will be covered in detail by Paul Thirkell elsewhere at this conference. For the purpose of this paper, and in order to position the separate processes of print on ceramic, they will be divided into several distinct process areas. In reality, the borders of these processes are far more blurred.

Ceramic and enamel on metal print history began in the 1750s with the appropriation of images from copperplate engraving. Whilst both under glaze and on or over glaze printing occurred at this time, the first patents seem to suggest that enamel printing on metal with on glaze colour was first. By glaze, we mean a coloured glass fired at a high enough temperature for it to liquefy and spread across the surface of the artefact being fired, which will re-solidify when cooled, thus producing a permanent, vitrified surface. On glaze or enamel refers to a coloured glass that is fired on top of the initial glaze. In ceramics the pot is first fired to a state called biscuit ware, then glazed and re-fired; the pot may have coloured pigment applied to the biscuit surface before it is glazed and this is known as under glaze. In enamel on metal, the on glaze enamel is fired directly onto the metal.

However, it is under glaze blue that most people associate with the 1750s. Here the copper plate was inked with a ceramic under glaze pigment, commonly cobalt or manganese oxide mixed with copperplate oil. The images were then printed onto a delicate sheet of tissue paper called, appropriately enough, potter’s tissue. The tissue is akin to the paper used in the 19th-century reproductive copperplate printing industry for chine collé, where the resultant prints were sold for a premium as being printed on India paper. This Royal Doulton toilet is an excellent example of under glaze tissue printing. (Illustration No 1.)

The newly taken wet print was applied to a biscuit fired pot. When dry, the tissue backing is washed off with soap and water and peeled away from the glaze, which remains adhered to the surface. The pot is dried then covered with a transparent white or cream glaze and fired, hence the term under glaze, literally meaning under the glaze. Under glaze tissue developed to a very high degree of sophistication. To quote Pat Halfpenny from the catalogue Penny Plain and Two
Pence Coloured, which documents ceramic printing by this method: 'Transfer printing is a particularly English form of ceramic decoration'. It is exemplified by this Sunderland pot from 1792. (Illustration No 2.) The anti-slavery message is taken from a Gilray Cartoon of the period. The beauty of Sunderland ware was its method of appropriating imagery from contemporary life and just applying it to the ware regardless of form and function. The best contemporary example of under glaze printing is either the domestic toilet bowl or the urinal: this illustration is by the British ceramic and print specialist Paul Scott. (Illustration No 3.) The fly image is a pun on the Dutch Urinals, which have a single fly printed in the toilet bowl, partly as a company logo, but partly to ensure that males of the species direct their flow in the appropriate place and not all over the floor. These artefacts exemplify the added durability and total resistance to washing and hard wear that are so characteristic of under glaze printing. Because the printing is encapsulated between the vitrified ware and a hard glass surface, it is the closest to permanency and longevity you will find. This factor has long been overlooked by artists and printmakers, but with the burgeoning of public art commissions in England, for instance, a new demand for artwork that cannot be defaced or altered and can undergo rigorous cleaning regimes has been created. It may seem obvious, but this very demand has led artists to use the process for its permanence, not the traditional plastic qualities.

The next historical development was to replace the tissue with a slab of gelatine. This form of printing is known as bat printing. The copper plate is inked with a plain, transparent varnish, usually heavy copperplate oil. A slab of gelatine approximately a quarter to half of one inch thick is laid upon the plate and an impression taken. The slab is placed against the ceramic ware, thus transferring the varnish. The ware is then dusted with ceramic pigment, dried and fired. The gelatine slab is cleaned of varnish and another print is taken. This process is the forerunner of what is now known as pad printing. The process uses a large, convex silicone bombe, or more accurately breast, which is pressed onto a flat engraved plate, lifting out the ceramic glaze, and then is stamped onto the inside of a curved object such as a dish, thus obviating the need for a transfer. The advantage of this process is its ability to print around complex curved surfaces.
Bat printing was followed by lithography, where the method was to create a waterslide transfer, again using a plain transparent varnish, in this case printed onto a pre-gummed paper, which was then dusted with ceramic on glaze enamel colour, followed by a covering coat using unhealthy, heavy solvent to create the waterslide decal. By a waterslide decal I mean the kind of transfer you used to stick to your plastic model aeroplane kit, or the temporary tattoo you applied to your arm as a child. This method produces a very accurate but delicate result, as the varnish allows very little ceramic colour to stick. (For clarification, the words transfer and decal mean the same thing.)

Finally in our potted history we come to screenprinting. In the 1950s a transfer method for screenprint was introduced which uses a heavy solvent mixed with the enamel pigment printed onto a gummed paper, followed by a covering coat using even more unhealthy, heavy solvent to create the waterslide decal. Its advantage is that a much heavier deposit of ceramic colour than with litho can be achieved. However, since the early 1900s, at the very beginning of screenprinting’s history, enamel on metal panels have been directly printed with coloured on glaze enamel. Excellent examples of this may be seen in the British post box and London Transport bus stop signs. These are printed by Burnams, one of only two UK traditional commercial enamel sign producers.

Up until this point nearly all these processes were primarily autographic. Since the 1970s screenprinting and lithography have both become primarily photographic. However, they were not the earliest examples of photo-ceramics, and a short digression will take place in order to explain the early rise of photography in ceramics. In the 19th century, approximately the 1860s to '70s, the gelatine bat bore close relation to the light sensitive gelatine emulsions becoming prevalent in photography and photomechanical reproduction. This relationship probably enhanced the speed of development of photo-ceramics, where a layer of light sensitive gelatine emulsion containing coloured enamel glaze was coated onto the surface of the ceramic artefact, exposed to a negative, washed in warm water to develop the image and then fired. The primary use of this process has always been for images on gravestones and this practise is particularly prevalent in Italy. Here is an image taken in the graveyard at Cortona from 1911, probably the period of
highest quality. (Illustration No 4.) It is noticeable how the quality of reproduction deteriorates the newer the panels are.

To recap, I have primarily discussed four areas of ceramic print: waterslide decals/transfers, under glaze tissue printing, direct screenprint and photo-ceramics. There are many other subdivisions.

So much for the potted history. Involvement with ceramic print at the Centre For Fine Print Research began with the development of screenprinted ceramic transfers using water-based ink. This has evolved into large-scale research covering a wide range of printing onto ceramic and metal surfaces, including photomechanical flexographic plates for printing with traditional under glaze tissue, both for on glaze and under glaze on metal and ceramic plus a means of producing continuous tone photo-ceramic panels.

To begin with screenprint. In 1998, the research team at The Centre For Fine Print Research successfully filed a patent for an on glaze screenprinted ceramic transfer process using water-based, solvent free (i.e. hydrocarbon free) media which had no smell and were healthy for the user. We have discussed and demonstrated this process at previous conferences, so apart from a brief description this paper will concentrate on where this research has now led.

The initial approach taken for this piece of research is exemplified by the primary researcher in the project, Kevin Petrie. Kevin Petrie first trained as an illustrator then took a postgraduate degree in Ceramics at the Royal College of Art in London. His Ph.D. was in novel screenprinted water-based ceramic decals. Having developed a system which would work, undertaken in combination with our university's Applied Science department, Kevin's primary task was then to demonstrate the qualities of the process developed to its best potential without undermining his integrity as an artist. The artwork is hand-drawn onto various layers of True-Grain (Lexan or Mylar in American), the screens are made up and printed in colour on the transfer paper with ceramic glaze. The decal is then transferred to the plate and fired to 850 degrees Centigrade, about 1100 Fahrenheit. Kevin applies his decals to industrially produced fine bone china dinner plates and crockery. They are often signed and numbered on the face as an
editioned print and are deliberately exhibited in printmaking exhibitions. The first illustration is from a set entitled *Meat Dishes*, which are drawings from gay pornography magazines printed onto commercial meat plates. (Illustration No 5.) The next image is from a series created after a week's holiday and forms the basis of a sketchbook diary of that week. (Illustration No 6.) The illustration shows the title plate from the set. Their ceramic references are to early British printed ceramics, where any transfer that was pertinent to the message needing to be conveyed was randomly applied to a variety of sizes of pot regardless whether it fitted or not, as in the Sunderland jug illustrated earlier. The combination of using industrial mass-produced ware, having a printed image which defies the convention of being subservient to the shape and function of the artefact, is in total contrast to the craftsman potter approach of form and function prevalent for the latter half of the 20th century within a Western European tradition.

In order to test the parameters and limitations of the process in a broader context, an exhibition of printed mugs by artists was organised: each artist was invited to submit a series of stencils, which were then printed as transfers and applied to industrial mugs. The exhibition opened last March in New York. (Illustration No 7.) Fifteen artists were invited from each of three countries - the UK, Holland and the USA - making forty-five in total. The exhibition moved to the Fusion Gallery, London in June and opens later in the year in Enschede, Holland. The limitations of the process highlighted are a lack of flexibility in the decal coating (therefore a new coating layer is in development) and poor rendition of reds, a problem for all ceramic decorators, but perhaps marginally worse in the UWE system. The far greater plus side is no unhealthy solvent and no nasty smells.

What does this process actually offer the creative artist? On the face of it, nothing new: however the real advantage of the process is that it has no barriers in the form of smell and stringent health and safety regulations, therefore it demystifies the process. It now has become easy to use and consequently accessible to a much greater variety of artists.

I stated earlier that enamel on metal has historically been directly screenprinted. The process has long been used by artists to create large-scale, permanent outdoor artwork. (Illustration No 8.) Illustrated is an example of a huge outdoor
project directly screenprinted by the British artist Dale Deveraux Barker. Each of these panels is over 12 feet, or 4 metres, high. Due to the circumstance of having a three-year research project in place we now have the opportunity to explore all aspects of printing on metal. The fundamental difference between enamel and ceramics is that ceramics are fired in a closed kiln where the temperature rises slowly, typically between 50 and 100 degrees Centigrade/Celsius an hour; once it has reached temperature it is slowly cooled, over a number of hours. With metal, the plate is placed straight into a kiln at 850 degrees Celsius for perhaps a minute until the enamel melts to form a glass glaze, and then is withdrawn straight from the kiln into the cold atmosphere. Any printing therefore has to be able to withstand the immense thermal shock involved.

How then will a transfer stand not only the thermal shock, but also the huge coefficient of expansion at the same time? The metal sheet will expand in size rapidly once it is inside the kiln and consequently shrink back as soon as it is removed. The answer lies in two factors. Surprisingly, the solution is to remove the entire medium binding the enamel pigment. In our system this burns out at a very low temperature, around 250 degrees Celsius. Once this is removed it allows the enamel pigment free movement and therefore the ability to expand in line with the metal. Secondly, it also allows free passage for the organic solvent of the pre-cover coated layer to burn up through the enamel without it displacing the pigment. The secret therefore is to slowly heat the plate on top of the kiln until its temperature is closer to the crucial 250 degrees Celsius required for burn out.

What added benefit does this bring to the artist? Firstly, it means you can prepare detailed imagery in duplicate which can be applied at any point in the development of a piece when necessary. You can prepare parts of your image by hand or computer remotely before even starting on the actual enamel artefact. The level of detail obtainable is far in excess of direct printing. It also cuts down the number of firings to reach a full colour image. In short, it makes life quicker, healthier and easier, therefore leaving much more time and freedom for the creative process to happen.

This illustration is of a very large commission undertaken by the artist/researcher looking at print on enamel, Elizabeth Turrell. (Illustration No 9.) The commission
was to create 200 panels for a new Children's Hospital in Bristol, UK. Most were only 25 centimetres square but 30 were in excess of 2 metres by 1 metre. The panels are part of the hospital signage and commemorate the donors who contributed towards the cost of building the hospital. Each panel consisted of two parts: firstly the bulk of each panel was hand painted by a schoolchild or school and then fired; then the donors' accreditation or the hospital signage was applied in the form of a printed transfer and fired onto the panel. A simple and, at first sight, not very exciting use of print, but what this process allowed was each panel to be decorated by the children without compromising each company's image.

If the ability to screenprint the transfers and apply them at the final stage in one firing had not been available, none of the companies would have allowed their logos to be subjected to children under the age of 10. A great shame, as children would produce a much more interesting result. It also allowed for the large panels to be made in manageable 25 centimetre square sections where the writing can be printed in one piece, then cut and assembled across the panels without colour bleeding over the edges or the metal cutting the screens whilst being printed.

Having found a good method of printing ceramic decals, it seemed sensible to apply ourselves to older ceramic print techniques. Under glaze tissue printing from an engraved copper plate was the ideal candidate. One of the central tenets of the Centre For Fine Print Research is 'looking back to go forward'. It makes no sense to throw any of the old techniques away just because something new and exciting has come along to temporarily replace it. That is not to say that we want to retain old techniques just because they are old techniques - on the contrary, we are interested to see if they have anything new to offer in combination with, or as a reappraisal of, new developments within print.

Under glaze tissue printing offers several advantages. The primary one is that the tissue is flexible and may be moulded around a compound curved surface. When printed from an intaglio plate it carries a high proportion of colour. The process can produce very crisp and detailed imagery. Its disadvantages are that it is painfully slow and has a high learning curve for both printmakers and ceramicists and needs good manual dexterity. Neither of these is a deterrent to the artist. Speed of production in commercial terms is not a major factor in artistic production. What
can be a problem is the production side of copperplate engraving, as this can be a
time consuming business that in itself requires a very high degree of skill. Also,
engraving does not have the capability to render a photographic image.

A decision was taken to replace the copper plate with a flexographic or
photopolymer plate. This is nothing new - the use of polymer plates here in
Scandinavia for photogravure is well documented. The combination of polymer
plate and tissue has given us all the autographic qualities of tissue printing plus the
potential of high quality photographic reproduction that is permanent, vandal-proof
and can be wrapped round compound surfaces. It was also necessary to change
the ink from traditional copperplate oil to a rubber-based medium used for relief or
lithography. This process now gives us the ability to make the intaglio flexo plate in
20 minutes rather than the several months it previously took, and it is quite
feasible to produce accurate, photographic, computer-generated four-colour
separations onto laser films that can be printed in a very short time.

In short, the process is undertaken by first exposing the plate to ultraviolet light
through a film negative. The plate is then washed with warm water to remove the
soft, unexposed parts of the polymer coating and after drying the plate is ready for
printing. The plate is printed in a manner akin to etching, with an ink now made
from a rubber-based medium mixed with the under glaze body stain or oxide to
make an ink similar to a traditional etching ink in feel and use. The plate is
scrimmed in the normal manner and printed with a piece of potter's tissue between
the plate and the backing sheet, which is a standard piece of etching paper, rather
in the manner of chine collé.

After printing, the potter's tissue is peeled from the support sheet, then lined up on
the ceramic artefact in register, and rubbed down with soft soap and water. The
tissue is peeled away from the ceramic surface, leaving the under glaze stain in
place. After each colour is printed and dried the tile is pre-fired to 600 degrees
Celsius to fix the under glaze stain, then glazed with a transparent glaze and re-
-fired to whatever the final glaze temperature of the artefact requires.

The illustration shows an early 4-colour printing test resulting in a glazed tile fired
to 1260 degrees Celsius, thus producing a permanent, non-fading, light- and
vandal-proof result - unless you drop it, then it is no longer permanent.

(Illustration No 10.)

We have replicated this process for both on and under glaze and also for intaglio and relief printing. Primarily, better results are obtainable using intaglio for under glaze, and relief for on glaze. The system for relief printing has the advantage of not only being flexible, and therefore capable of being wrapped around a compound surface, but also has the advantage that once you have exposed and washed out the flexographic or photopolymer plate, no printing equipment apart from a roller is necessary.

Once rolled, the tissue is laid down onto the plate and rubbed in place with a finger. The inked tissue is peeled away and then placed on the tile or artefact in the normal manner for tissue printing. Once the plate has been made, the whole printing process is very swift and extremely easy; apart that is, from lining up multiple colour tissue in register.

What, therefore, cumulatively do all of these processes have to offer and why have we gone down this road? Firstly, I believe that unless new opportunities and methods of making through process are explored, the generally accepted myth of digital, screen-based imagery being the only future will persist. Unless we appraise traditional process in context with contemporary demands it becomes dead technology and harder to justify maintaining its existence. There is a growing demand for a visual aesthetic. By taking a holistic approach to the development of process and its integration with new and digital technologies, the future, from my point of view, has a creative unity. The previous divisions between art and craft are no longer sustainable in the 21st century. What concerns me is the retention of a skilled manual and practical ability to use a common visual language. The best artwork is a combination of content, visual aesthetic and tactility of the artefact.

In digital, screen-based output, the rendition of colour and clarity has become infinitely more accurate in the last few years, but still lacks the tactility of a physical output. The methods described are just one route to allow the creation of a tactile artefact integrated with new technology that can be produced within a contemporary time frame. They also allow the retention of a high degree of
purposeful craft skill and give an entry point to the historical context of making and the making of art.