Printmaking with Extreme Technology

Beyond Digital

Stephen Hoskins
Hewlett Packard Chair of Fine Print: University of the West of England, Bristol

(Slide 1)
I have called my section of this panel ‘beyond digital’ and yet to my mind I am demonstrating images that use technology already available in many universities, but not commonly used by printmakers. Primarily these are either industrial processes or are in the process of being adopted as industrial process I am going to highlight examples of two of these technologies Rapid prototyping also called 3d printing and laser cutting technology.

I am convinced there is a necessity for a fundamental shift of approach to digital technology, which has yet to be encompassed by printmakers. Even though they have quietly adopted digital printmaking as an integral part of the printmakers’ armoury. For too long printmaking has denied its roots and the traditional printmaking processes have drifted away from their commercial and industrial heritage, even screenprinting the baby of the processes, bears little relation in its artistic form to its industrial heritage.

First I will lay some ground rules before I explain why I think this fundamental shift has to take place, then try and demonstrate some of the processes, accompanied by examples of the artists we work with at the Centre for Fine Print Research who are using these technologies.

For the Printmaker, digital printmaking primarily takes two forms. The most obvious is ink jet printing, which with the advent of pigmented ink and specialist coated paper such as the Hanamuhle and Somerset ranges has been almost universally adopted. The other is the integration of digitally generated imagery into the reprographics processes of traditional printmaking. Here I mean the replacement of traditional film positives generated from a photographic negative, with a digitally generated film. These film positives or negatives are then used in an identical manner to the traditional processes. Although they are a different means to an end, the fundamental conception is nearly always based upon imagery generated within pixel based programming in this case Photoshop.
(Slide 2) (Slide 3)
There is no doubt that up to this point in time such pixel based programming has served us well. The quality of image obtainable as standard in 2009 is beyond anything most of us dreamt of twenty years ago in 1989, the year Graham Nash bought his first IRIS printer.

Concurrent to these developments has been the rise of digital technology within engineering for the manufacture of 3 dimensional objects, (Slide 4) primarily developed from Computer Numeric controlled milling known as CNC, now developed into a host of technologies that include, Laser cutting, for wood, metal and plastics and Rapid Prototyping or 3D printing. The important factor here is the word numeric in Computer Numeric controlled. (Slide 5) In printmakers terms, to manufacture an object in 3D you need to be able to have a 3 dimensional set of registration marks, known as an XYZ axis. Or to put that another way, X equals forwards and backwards, Y equals sideways and Z equals up and down. All measured from the bottom left hand corner. In order to use these technologies the fundamental shift required of the printmaker is away from pixel based programmes to vector based programmes that define an area then fill it with colour, such as Adobe Illustrator. These programmes have inbuilt spatial reference and so can be used in relation to engineering technology.

The best way to demonstrate this fundamental shift is with the work of the artist Richard Hamilton, (Slide 6) in 2003 we produced a large digital print for Richard 'Typo Typography' based on his translation of Duchamps notes for the large glass. Created in Adobe illustrator the file consists of about 1000 layers and took six months to create. (Slide 7) The final prints measured 6 feet by 10 feet. In the time we have worked with him Richard has worked in Photoshop, Illustrator, Lightwave and now Rhino. Richards ability to assimilate changes in technology meant that when we came to create a medal of Dishonour commissioned by the British Museum, (Slide 8) he understood the need to reference a photographic image to an xyz reference point in order to create a 3d relief surface. Shown in the slide is the file of the 3d relief, this was then tested on several types of rapid prototype machines in order to obtain the best quality. (Slide 9) The final version did not use 3d printing but CNC milling which is best described as computer controlling a drill in 3 dimensions that cuts away the material, leaving the image you wish to create. Having created the master relief matrix, this was then cast in wax and 5 medals were cast in silver. This image went through much iteration and Richard and his son Rod developed a method of viewing the virtual relief surface on screen in order to make iterative changes without the need for to constantly print samples.

Not only does this image demonstrate the need for printmakers to assimilate technologies other than the pixel based Photoshop, it also raises in a very different way the old question of where an object ceases to be a print. This problem or not is admirably demonstrated within this piece. The initial trials were all made using a 3d printing technique. The final matrix was created by a CNC process but using the same file as the print. The image was then cast and replicated from a mould, I am intereted as to where the process stops being print and becomes sculpture, or does it?

However, you need to know how rapid prototyping works, here are our 3d print research labs in Bristol. (Slide 10) We have three rapid prototyping machines, two by Z-corp. and a large machine by Objet. The best way to think about the technology is that it prints in layers each one on top of the other. There are many versions of the technology and the following slides demonstrate how one common process, the Z-Corp system works. (Slide 11) (Slide 12) (Slide 13) (Slide 14) (Slide 15) (Slide 16) (Slide 17) (Slide 18) (Slide 19) The machine consists of two square boxes one full of plaster powder and the other with a plate at the top, covered with a thin layer of plaster powder on which the object is going to be built. An ink jet head deposits the first layer of binder and a roller places a layer of plaster over the binder. The process continues on layer at a time as the printing plate slowly lowers to create the build height, when the object is built the printing plate is raised to the top, (Slide 20) (Slide 21) (Slide 22) (Slide 23) excess powder is sucked out and the finished object is removed from the machine. Here are a series of stages of the actual machine as it is printing. (Slide 24)

For the past two years we have been working on a project testing the potential of 3d printing in low cost manufacture for Artists and designers, funded by the UK Arts and Humanities Research Council. One aspect of this research is to work with a number of artists and designers and here are some of the early results. (Slide 25) This image called Fish Pig is by Paul Sandameer and I have some examples of this work with me. (Slide 26) (Slide 27) The next two are by Dr Peter Walters who is a designer who specialises in adopting natural forms into his design. The first set, are based on anemones. The second set, are more fluid and are based on Peter's work with robotics and flexible actuators. (Slide 28) The final images are the core of the research project, where we are attempting to move rapid prototyping into specialist production for Artists and craftspeople. Here we have objects that have been printed in stoneware ceramic body that is held together with the binder. Once printed the object is dried and then fired in the kiln to 1060 degrees Celsius/ 1940 degrees Fahrenheit, the final result is solid fired 3d ceramics, the same as any cup or tableware you pick up except that this version is printed.

(Slide 29) To move forward Laser cutting like CNC milling is a subtractive procedure. It burns the image away; in this instance the X and Y-axis, the forwards, backwards and sideways are controlled like the 3d printing in the same way, as a desktop printer except this will always go back to the registration corner. (Slide 30) To replace the Z axis the laser is controlled with speed and intensity. Her are our laser cutters at Bristol, we can cut from delicate paper through to one inch thick sheet acrylic, up to five feet by three feet. We can also register any inkjet printed image and cut it accurately as long as it has been created or imported into Illustrator. It is very simple to create a cut line within a vector image.

. (Slide 31) To demonstrate this, here is a Lesley Dill we have laser cut as part of a number of works from a large scale collaborative project with Lesley and the Brodsky Center. . (Slide 32) We have been making a number of works that are either illuminated with light or use natural light to illuminate them. Having advocated vector programmes, this of course is cut from a Jpeg file, which first has to be translated into black and white then eight levels of grey tone; this controls the intensity of the laser and therefore how deeply it cuts. . (Slide 33) The deeper the cut, the more intense the black, primarily as the sheet is burnt more in the darker areas, but as you can see from this image you can create a sculpted relief surface with the laser. At its darkest the laser has just burnt through the paper and the resultant texture you see is a combination of laser path and the construction of the Saunders paper. When illuminated this sheet shows how the paper blocks the light like a watermark.

It is this changing intensity of light through laser engraving that we are exploiting in this next Lesley Dill. . (Slide 34) This image consists of a main front sheet ink jet printed onto thirty five gramme Japanese paper, this is backed up by two laser engraved sheets of somerset, one white and one black, both sculpted in the manner seen on the last print. . (Slide 35) This is followed by a series of light emitting diodes and a set of hidden electronics and sensors that will illuminate the image as you walk up to it and then fade as you walk away. All packed into a frame only one inch deep, and here is the result.

. (Slide 36) In comparison the work we undertake with Charlotte Hodes an English artist is much simpler. The works are made up of two ink jetted sheets, a backing sheet and a cut top sheet, but also some of the laser cut-outs are added to the top sheet. It is hard to grasp from these slides but these prints have a tactility that transcends the ink jet process. . (Slide 37) . (Slide 38) . (Slide 39)

As I work back towards traditional print, I thought I would show you some aspects of digital that we take for granted in our everyday lives but have yet to make much impact on the printmaker. (Slide 40) . (Slide 41)

I have included a project we undertook with the UK's largest Road sign company to introduce them to digital technology. The everyday aspect of this is the vast amount of wrapped vehicle livery that is now ubiquitous. We have used this technology for numerous projects but in this case here is a project that demonstrates the anniversary of the abolition of slavery. In this case to maintain light levels and make the images visible outside they were created from 3 layers of vinyl and then rotary cut to create 85 individual pieces, which is what was displayed in the window.

These are a series of enamel on metal works by the ceramicist Richard Slee. . (Slide 42) He took a series of everyday tool such as builder's trowels, spades,

saws and rakes and coated them with enamel glaze and fired on digital decals. (Slide 43) Enamel on metal is an industrial process that is used in everything from Baths to Ovens via Road signs and cookware. (Slide 44)
To conclude: I have in the past at this conference alluded to the artist formally known as the Printmaker, at that time we were grappling with one new technology which was inkjet. Now there is a whole panorama of new technologies far beyond that we have used in the past, that moves beyond the flat paper surface and takes us into a whole new realm of three dimensions

Finally printmaking has a unique opportunity to be integral to and lead the way in contemporary art practice, as printmakers we tend to have an innate grasp of the combination of process and practice. However to make the fundamental changes necessary to embrace this technology we need to do two things. The first is to understand that Printmaking is a developing culture, therefore we need to embrace the new and the old together, and to a large extent this is already happening. At the same time we need to regain our relationship with the developments in our own industry and acknowledge that printmaking has a continuing commercial and industrial heritage that runs concurrently to the art market, that for too long has been denied.
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