The Impact of Paper on Ink: From the Photomechanical Printer's Perspective

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Abstract

This presentation is concerned with the substrate and how the print process can affect the visual aesthetic. There is a difference between the user who requires a general consistency of image on any paper substrate and the user who has a more subjective approach to the visual appearance of ink on paper. With the introduction of photo enhanced papers and non impact printing processes, there are some implications for the user, which are: the overall visual impact, quality of the image, the relation of ink and paper, surface quality of the paper and the surface quality of ink and paper. Whilst users who require a high turnover print production require a consistency of image, this does not necessarily mean that the image has a high subjective visual quality. By quality we mean, colour resolution, parity to the image on the screen, contrast, colour range, subtlety of tone, continuous tone, good light tone, how it interacts with the paper.

The subjective user requires choice beyond the high volume impositions; we aim to demonstrate how the choice of process and paper can create a quality of image, which may more closely represent the creator's intention in the original artwork.

Introduction

One of the objectives at the Centre for Print Research is the development of the photomechanical print - instead of chemicals and light sensitive paper, a printing press, plates and artist's paper are used to print photographic images. With the impact of digital technology and non impact print processes, the production of continuous-tone photopositives for plate-making has enabled a reinvestigation of the 19th century print processes (1) such as collotype and Woodburytype to produce multi-colour images with a wide colour gamut and richness of tone. Although non impact print processes provide a useful means of image reproduction, there is still a short-fall in the quality. The Centre is aiming to address these issues.

From Image to Print

The production of a printed photomechanical image usually requires four stages:

- Creation
- Image capture
- Information translation to print device
- Print

The creation of an image, until now, has occurred in hard copy of some sort whether autographically or as a photograph. With the recent development of digital technologies, software and hardware devices enables an image to be digitally captured, inputted, manipulated and printed with greater speed. Image capturing hardware has also changed how images are generated and stored. Scanning devices have primarily replaced reprographic photography. Information translation to print in commercial terms, at least, is almost entirely undertaken by digital file transfer ie. through an image-setter to film, directly to plate or in the case of inkjet ripped directly to the printer. Commercial pressure has mediated these processes as closed loop systems. The original artwork is scanned, the scan is colour calibrated to the original, the scan is then colour separated to CMYK and under the limitations of the colour gamut is calibrated as accurately as possible. The plate is generated and the print calibrated as accurately as possible to the original. This system is useful for accurately measuring only colour rendition within a given set of parameters.

The Digital Portfolio

The importance of choice beyond the above criteria was demonstrated by the Centre for Fine Print Research's collaboration in a project called the Digital Portfolio, which was instigated by Permaprint of London and published by the Paragon Press. The portfolio consists of twenty-two different photomechanical print processes each with the same image generated with one common digital file. Each process is then printed in CMYK to the highest quality capable within the parameters of the process.

The result is a selection of twenty-two very different prints. The colour rendition is extremely variable partly because this was not a scientific study and the colour gamut was not quantified for all the processes. As there was no original from which to work, the printer technician used their subjective judgment to quantify the fidelity of the image within their own experience of the process.

The benefits from this portfolio lie in these subjective judgments. Paper was chosen by the printer, which from their experience would achieve the best results from that particular process. Colour was balanced between each of the four colours in a given CMYK or equivalent set and not to an original, which might serve only to highlight the gaps in the colour space. Most importantly the folio serves to highlight the need for choice. Subjectively each of the print processes has a set of qualities beyond mere colour rendition. It is not possible to demonstrate this through slides or standard photography, as the result would be filtered by another process. It is however possible to demonstrate the potential benefits of each differing process through micro photographs of a section of each print. These will be demonstrated and discussed. A selection of images from the portfolio will also be available to view.

Microphotography

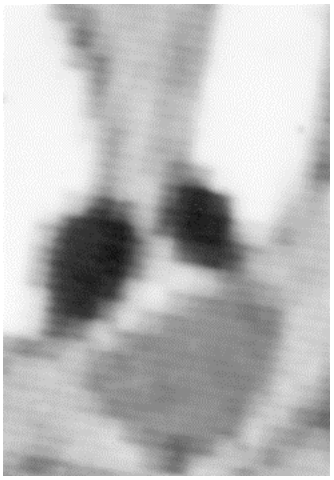

Figure 1. dye sublimation

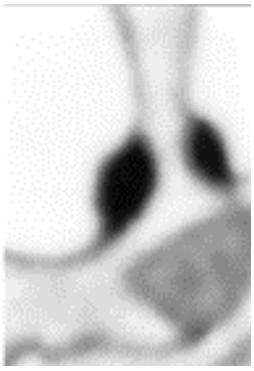

Figure 2. Cibachrome

The microphotographs were taken using 50x magnification through a standard microscope fitted with a Pentax 35mm camera.. 3 separate fibre-optic light sources were used to illuminate the samples from above. To enable accurate comparison to take place, a standard 1 centimetre x 1.5 centimetre section was cut from the same spot in each print. In order to quantify the depth of ink deposited in relation to the microphotographs, a further thin cross-sectional slither was cut from the long edge of each of the sample sections. As a control mechanism a further cross sectional slice was taken from a very dense section elsewhere within the print.

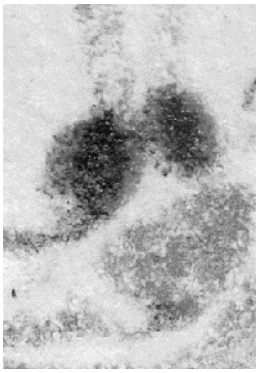

Figure 3. dust grain photogravure

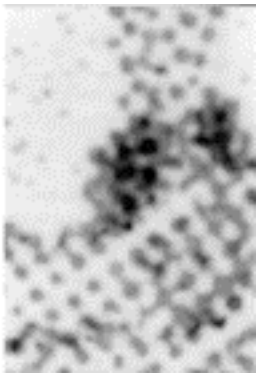

Figure 4. coated

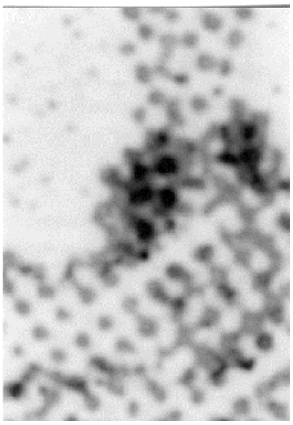

Figure 5. un coated

Two factors for each process will be closely demonstrated. The first is the quality inherent in each print. This is most closely demonstrated between the photographic light generated processes such as dye sublimation and Cibachrome (fig.1 & 2) and the traditional historic print processes such as dust grain photogravure (fig.3) and collotype. The second major factor in this visual change is inherent to the paper substrate. This is most clearly demonstrated by the traditional letterpress process, from the printing of a halftone relief block. The prints were colour balanced to a gloss coated printing stock and a mat uncoated stock was run at the same time. (fig.4 & 5)

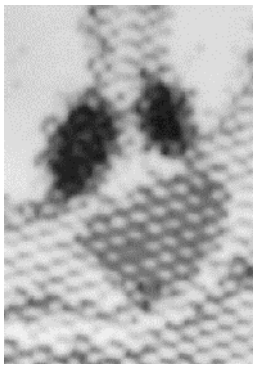

Figure 6. Iris coated

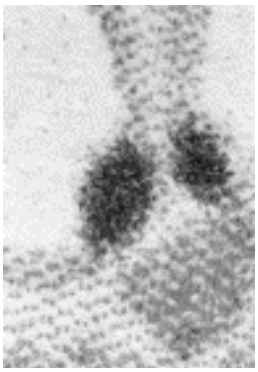

Figure 7. Iris uncoated

The inherent print quality of the uncoated stock, has a nostalgic feel of a 1950s textbook. This particular quality would be unobtainable with any other process as it relies on the particular relationship between the ink, the printing stock and the print process, not on accurate colour rendition from a particular digital file.

This subjectivity of image in relation to print stock is also clearly demonstrated by comparisons between the dustgrain photogravure sample and the Iris print on coated and uncoated stock (fig.3 and figs.6 & 7). The Iris uncoated and photogravure are both printed on 300 gsm Somerset Satin. This graphically displays why photographers are still choosing Iris prints with fine art paper as their favoured digital print process.

The set of cross sectional tests clearly reveal distinct differences between the traditional early print processes and the new digital non impact processes. The very clear deterioration of the surface of both the laser print and the match print, (figs.8 & 9) led to direct comparisons with the cross sections of the early and fine art processes.eg. screenprint and dust grain photogravure (figs.10 & 11).

The clear absorption of the pigmented ink in these samples is visual evidence of the long term stability of these processes.

Figure 8. laser print

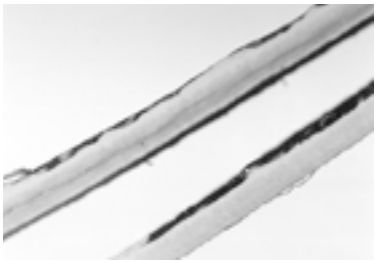

Figure 9. match print

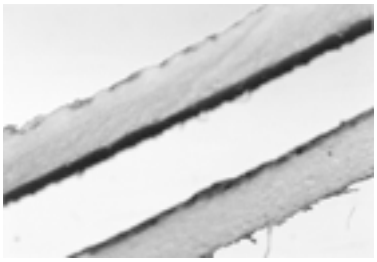

Figure 10. screenprint

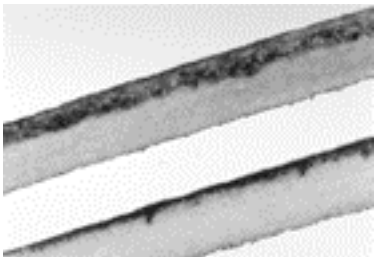

Figure 11 dust grain photogravure

Inkjet on Archival Paper

Current developments in inkjet have led to the development of dedicated photo enhanced and textured papers. Printer companies have often developed paper that is designed to be used only on particular printers and using specific inks, inferring the quality of the image might be impaired if other generic media is used. These papers are designed for high volume print reproduction or for the home user. The longevity of the paper and the ink, for these users, is not so much of a priority. However a growing area for concern among artists, conservators and collectors is the lightfastness of digital prints and the relationship of ink on paper (2). A recent conference on inkjet printing, in the UK, highlighted these issues (3). Similarly as accelerated light fast tests are suggested to be flawed (4) real time light fast tests could over a shorter length of time, give an actual indication of the degeneration of an image.

The majority of artist printmakers use archival, cotton-based, hand-made papers. Some mills, such as St. Cuthberts Mill and Hahnemühle, producers of archival papers, are now developing new coatings to make them more compatible for inkjet. Similarly, manufacturers of digital inks are developing pigmented colour sets with more archival stability and with the intention of increasing the longevity of the printed image. However, from initial tests by the CFPR, the addition of the new coating to the archival papers is affecting the longevity of the image.

An alternative approach was undertaken by testing ink on a range of coated and non coated archival artist's papers. The Encad Novajet 63E 600DPI was used to undertake a series of tests:

- A real-time, natural-lightfast test onto a series of photo-enhanced commercial and artist's archival papers.
- A series of tests onto a variety of artist's archival papers to consider the subjective quality of ink on paper.

Real-time, Light-Fast Test.

Basic colour swatches were printed, using the 'prime' button to print cyan, magenta, yellow and black; and then colour combinations of red, green, blue, yellow and black. Ilford Archiva inks range were used. Tests were made on the Somerset Enhanced (coated 200gsm cotton paper), Somerset Velvet (an uncoated, 250gsm cotton paper), Novajet Gloss and Novajet Mat media (approx 100gsm). Test strips of each the papers were subjected to the following:

- Real-time, natural light test
- Real-time, natural light test, but wrapped in neutral pH tissue and encapsulated in clear plastic.
- Wrapped in neutral pH tissue, encapsulated in clear plastic and put in a dark box.
- Wrapped in neutral pH tissue and put in a dark box.
- Exposed to the atmosphere but kept in dark conditions.

The objective of the tests was to emulate general conditions in which many prints might be shown or stored, such as average light conditions, humidity, possibly dark and humid conditions, if for example kept in a plans-chest or under plastic wrapping. The intention was to check the samples once a week for three months. However after one day the samples in natural light conditions and those exposed to the atmosphere in dark conditions had already changed. Changes had occurred to the Somerset Enhanced and the Novajet Mat, where the magenta had bleached to a very pale pink. These results were interesting, suggesting a reaction to the humidity and atmosphere rather than the light conditions. After three months all the paper tests were compared to a freshly printed sample. The tests showed slow colour bleaching for the Novajet Gloss and the uncoated Somerset Velvet; and after the initial fading of the Somerset enhanced and the Novajet Mat a continued, but slower degeneration of the colour.

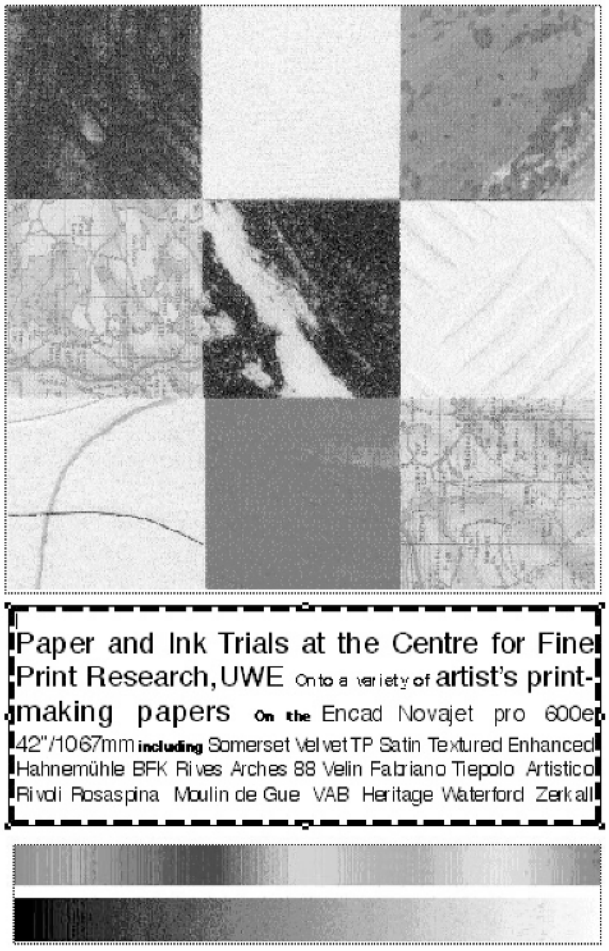

Figure 12 test page used for all paper tests

Ink on Paper Tests Onto a Variety of Artist's Archival Papers

A range of artist's archival papers were investigated in terms of, quite literally, the subjective qualities of how the ink mixed with the paper. The objective was to emulate methods by which an artist might generate an image and their expectations as to the quality of the final printed image. A piece of artwork was scanned, which comprised

collaged squares of different textures, embossing, collage and colours. The test page also included a grey scale, a colour scale, and text. The printed image was calibrated to match as closely to the original as possible. However it was impossible to obtain the richness of some of the colours and give an accurate indication of texture. Once the best colour balance was achieved, these colour combinations were used for the whole print run. A colour set produced by Lyson were used.

The papers that were trialed ranged from light-weight Japanese tissues to heavy-weight etching papers. A variation in the base colour of the paper was included, which ranged from a bright white to an antique cream. A series of criteria were used to judge the effect of ink on paper:

- Colour clarity - muddying of colour, brightness, saturation
- Text - feathering at the edges, density
- Paper- surface quality, chalky, dull, puddling or colour drag

Some papers (5) revealed surprising results. For example, a classic watercolour paper such as the Saunders Waterford -a mould made paper and surface sized with gelatine - one would expect to work well under water-based ink jet conditions. However the surface has a dappled quality, the text is feathered and the colours appear muddy. The Somerset papers, which covers a variety of weights, colours and textures presents a good overall quality over the entire range. The Somerset Enhanced, whilst specifically designed for inkjet with 5gsm starch coating to one side to make the paper more receptive, subjectively appears very hard: the colours are bright and the text is sharp. Examples will be available to view. Lastly, Aquarelle Satine, produced by the French paper mill Arches, is tub sized - the fibre is sized with gelatine during the manufacturing process - gives the final result a good overall clean image and soft colour rendition.

The results if quantified not by accuracy of colour rendition, brightness or luminosity, revealed a broad range of subjective qualities. Some samples revealed a fairly accurate and clean rendition of the CMYK and therefore had little subjective quality. Others where the colour may have been absorbed into the surface showed a rich and dense quality with a very short tonal range but a high subjective appeal. Other samples, on a Japanese paper for instance, showed a delicacy unobtainable by any other print method.

Conclusion

In conclusion the subjective qualities of paper stock and its influence on the total visual appearance of the final printed image has, in general, not been sufficiently explored. One example is inherent in the rendition of a full tonal range. Since the 1950s the rendition of a black and white tonal image has a much smaller contrast range. Though the ends of the scale have increased, the central stepping across a Stouffer wedge has shortened. The Photo Secessionists of the early nineteen hundreds (e.g. Alfred Stieglitz and Paul Strand in Camera-Work) did not use dense blacks or harsh whites. Their work is now judged as of the highest photographic print quality.

Many contemporary photographers, such as Bailey and Mapplethorpe turned to the pigmented photomechanical processes such as platinum and photogravure. These processes were also used by the Secessionists, not just for the archival qualities but for the very particular and accurate subjective qualities that were obtainable. These photographers and artists chose paper and print combinations not specifically for the accuracy of colour rendition, but for the combination of colour, surface tactility and visual relationship between paper stock and pigment, which result in the need for a far more subjective qualitative judgment.

References

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2. Pam Roberts, Into the Light, Photographic Printing out of the Darkroom, Royal Photographic Society, Bath, 1999
3. Preservation and Conservation Issues Related to Digital Printing, The Institute of Physics, London, (26-27th October 2000); and Carinna Parraman, The Inkjet in Question, Printmaking Today, 10, 2,(2001) p.28
4. Henry Wilhelm Image Permanence and New Tools, Border Crossings, Southern Graphics Council Conference, University of Texas, March, 7th -11th 2001
5. An introduction to papers can be found in: Sylvie Turner, Which Paper? A Review of Fine Papers for Artists, Craftspeople and Designers, Estamp, London, 1991

Biography

Stephen Hoskins is reader in fine print research and director at the CFPR, UWE and a fellow of the Royal Society of Painter Printmakers. His primary area of research is in continuous tone photomechanical processes and their application with current technology particularly in relation to printed ceramics, funded by the Arts and Humanities Research Board. His book on water based screenprinting has recently been published by A&C Black, London.

Carinna Parraman is research fellow at the CFPR, UWE. She is lead academic for a DTI funded project into writing colour profiles for artist's archival papers. Her main research interests are:

- Suitable papers for inkjet printing;
- A collaborative project with the Prints and Drawings Department at Tate Gallery, London which involves the cataloging of the collection by process and tracing the history of print technology in the 20th century.
- An investigation of photomechanical print.

She is a member and editor for the Printmaker's Council.