The longevity of ink on paper for fine art prints

Carinna Parraman, Centre for Fine Print Research, University of the West of England, Bristol, UK
Fine art papers
A CELEBRATION OF DIGITAL PHOTOGRAPHY
18 YEARS IN THE MAKING

YOU HAVE SEEN THE HOW TO'S. NOW SEE THE THE FINAL DIGITAL CREATIONS

Co-founded in 1990 by rock musician and photographer Graham Nash and R. Mac Holbert, Nash Editions was the world’s first professional fine-art digital printmaking studio. In the more than fifteen years since opening its doors in Manhattan Beach, California, Nash Editions has attracted leading artists — including Manuel Alvarez Bravo, Horace Bristol, Eileen Cowin, Eric Fischl, Lynn Goldsmith, Robert Heinecken, David Hockney, Pedro Meyer, Jenny Okun, Stephen Shore, and Maggie Taylor — and established an unparalleled international reputation for fine-art photographic digital printing. Nash Editions: Photography and the Art of Digital Printing charts the history of digital photographic printing from early experiments in the mid-1980s to the present explosion in digital imaging and printing technology that has overtaken traditional darkroom printing and brought the medium to a wide public. The work of Nash Editions represents the entire spectrum of artistic involvement in digital imaging since its inception as a viable alternative form of expression, from images composed in the computer or on a scanner to traditional photographs printed digitally from scans of a print or negative. The essays collected in this volume include an overview of the founding and development of Nash Editions by R. Mac Holbert; a history of photographic printing processes from the inception of the medium to the digital revolution by photographer and educator Richard Benson; and a detailed capsule history of advancements in digital...
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http://www.nasheditions.com
Richard Hamilton
The Mirrorkal Return (1998)
Iris print

(P78289)
Catherine Yass
Northwest F6 (2001)
Iris inkjet

P78592
Wolfgang Tillmans, *if one thing matters, everything matters*, Tate Britain 2003
Centre for Fine Print Research,
University of the West of England,
Bristol
towards continuous tone...

- digital halftoning
  - regular screen, dither, stochastic
  - needs a very small dot size and high resolution to achieve a good result

- variable number of drops
  - same ink density, small drops
  - reduces throughput as multiple drops/pixel

- different ink densities
  - multiple ink densities

- directly vary drop volume
  - vary waveform according to drop size
  - increases head complexity
  - no loss of pixel frequency
Richard Hamilton
Soft Pink Landscape (1980)
collotype

(P07447)
Peter Blake `It isn't manners for us to begin, you know', said the Rose  (1970)  
Screenprint in 11 colours

(P04042)
Richard Hamilton
A dedicated follower of fashion
(1980)
photogravure

(P07748)
Blue (Dye) ink on Somerset Enhanced

Blue (Dye) ink on Tosa Shoji
Somerset Enhanced is available from stock in the following sizes and weights. Although not a stock item 330g/m² is regularly run as a special making primarily for users of Muto and Mimarkki printers that require a heavier weight paper.

The A4 & A3+ sizes come packaged in 25's in attractive two part boxes with English, French, German and Spanish languages. A2 comes bagged in 25's and 1168 x 889mm is kraft wrapped also in 25. Rolls are boxed singularly using 3" cores.

<table>
<thead>
<tr>
<th>Size</th>
<th>Satin</th>
<th>Velvet</th>
<th>Textured</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4 - 210 x 297mm</td>
<td>225g/m²</td>
<td>225g/m²</td>
<td>225g/m²</td>
</tr>
</tbody>
</table>
Matt FineArt

These genuine artist papers made of 100% cotton or pure alpha cellulose present smooth and textured surfaces and are provided with a matt Premium-Inkjet coating. This special coating permits high quality printing.

smooth:
- Photo Rag®, 188 · 308 · 500 gsm
- Natural Art Duo, 256 gsm
- Photo Rag® Duo, 276 gsm
- Photo Rag® Ultra Smooth, 305 gsm new
- Photo Rag® Bright White, 310 gsm
- Bamboo, 290 gsm new

textured:
- William Turner, 190 · 310 gsm
- Albrecht Dürer, 210 gsm
- Torchon, 285 gsm
- Sugar Cane, 300 gsm new
- German Etching, 310 gsm
- Museum Etching, 350 gsm

others:
- Certificate of Authenticity new
- Hahnemühle Protective Spray
http://www.wilhelm-research.com

http://ppp10.iopconfs.org/index.html
Indications that affect colour changes

- light
- humidity
- storage
- ozone
- paper and ink combinations
- handling
Inkjet media

- Inkjet paper
  - Plain paper
  - Coated paper
    - Paper based
      - Glossy
      - Semi-glossy
      - Matte
    - Photo paper based
      - Glossy
      - Semi-glossy
  - Others
    - Glossy
    - Matte

Commercially available packages of inkjet papers are sold under various product descriptions such as glossy paper, photo-quality paper, photo paper, coated paper, matte paper, plain paper, non-coated paper, etc. This is because the manufacturers all use different product category descriptions. Below is a brief explanation of inkjet papers.

Inkjet papers can be classified as shown in the figure below. There are also some products that are not paper. Material for inkjet printing as a whole, including non-paper media such as cloth and film, are referred to as "inkjet media."

- Plain paper and coated paper

Classification is made depending on the existence of an ink receptor layer to absorb ink from an inkjet printer. Papers with no ink receptor layer are called "plain paper" or "non-coated paper," and those with an ink receptor layer are called "coated paper." Coated papers are greatly superior in image quality and color because their ink receptor layer is developed taking into consideration color development and fixing of ink. Coated papers are classified into several types such as glossy, non-glossy, etc., depending on the different kinds of surface. All plain papers have non-glossy surfaces, and are inexpensive. Plain paper is suitable for the printing of color data that mainly consists of text. Printing on media other than paper — such as film, cloth, and metal foil — becomes possible by forming an ink receptor layer on the material's surface.
Methods for measuring and comparing

- Delta E ($\Delta E$) - photography, graphics, printing, conservation
- Blue Wool - textile, conservation
- DMax - photography, graphics, printing
- Visual description
• Delta E ($\Delta E$) difference - a measurement to describe the total colour difference between two colours.

• Blue wool scale - a method of comparing eight blue dyed strips of wool, that have different lightfastness properties, 1 being the most sensitive and 8 being the most resistant to fading.

• DMax - compares the density of two printed ink samples.

• Visual - Microphotographs of samples
accelerated versus real time

- Testing can be separated into predictive and comparative methods:
  - A predictive test can attempt to make a suggestion on how long a print will last
    - It does not assist in visualising how these changes are occurring
  - Comparative testing demonstrates how printed samples will fade or change under particular conditions. Comparisons can be made, for example by measuring colour changes or paper samples, a visual inspection and a description of these changes, or through photography. Comparative testing does not predict the longevity of a sample.
accelerated versus real time

- Accelerated exposure - increases the exposure of light intensity whilst proportionately reducing the exposure time.
- WIR (Wilhelm Imaging Research, Inc.) - Display Permanence Rating, and is used as a comparison against other papers and inks.
  - law of reciprocity (calculating image degradation by simulating long-term exposure to light)
- Real time - takes into account the real environment
  - lengthy process - technology can quickly become redundant
What happens to inks on a micro scale?

- Whilst measurements are useful as a metric guide, a visual comparison is also useful. Therefore, the use of a microscope became both a tool for studying the relationship of ink to the paper surface, and recording the changes that were taking place to the ink dots over time.
Tosa Shoji 50% black

Rayon Unryu 100% black
50% cyan dye onto fine art coated.

50% cyan pigment onto fine art coated.
50% cyan dye onto fine art coated after 11 months.

50% cyan pigment onto fine art coated after 11 months.
50% cyan dye onto fine art uncoated. 50% cyan pigment onto fine art uncoated.
50% cyan dye on onto fine art uncoated after 11 months.

50% cyan pigment onto fine art uncoated after 11 months.
50% magenta dye onto fine art coated.

50% magenta pigment onto fine art coated.
50% magenta dye on onto fine art coated after 11 months.

50% magenta pigment onto fine art coated after 11 months.
50% magenta dye onto fine art uncoated. 50% magenta pigment onto fine uncoated.
50% magenta dye on onto fine art Uncoated after 11 months.

50% magenta pigment onto fine art uncoated after 11 months.
100% black dye on fine art coated.

100% black dye on fine art coated after 11 months.
## Comparison of Samples

<table>
<thead>
<tr>
<th></th>
<th>Dye inks on coated papers</th>
<th>Dye inks on uncoated papers</th>
<th>Pigmented inks on coated and uncoated papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patches visible</td>
<td>cyan not visible on 5% and 10% ink patches; magenta patches up to 80% on some papers not visible.</td>
<td>5% patches still visible</td>
<td>5% patches still visible</td>
</tr>
<tr>
<td>Intensity</td>
<td>Colour intensity very reduced</td>
<td>Colour intensity slightly reduced</td>
<td>Colour intensity only slightly reduced</td>
</tr>
<tr>
<td>Composite Black and Black only</td>
<td>Composite blacks and greys appear olive green</td>
<td>Composite blacks and greys of up to 75% appear greenish grey</td>
<td>Slight reduction in intensity for composite black patches</td>
</tr>
<tr>
<td>Other</td>
<td>Colour mottling and non-uniform fading evident</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A theoretically white paper...

- **violet** ~380-440nm
- **blue** ~440-485nm
- **cyan** ~485-500nm
- **green** ~380-440nm
- **yellow** ~565-590nm
- **orange** ~590-625nm
- **red** ~625-740nm
Spectral Curves of Papers
(measured without a UV filter)

Reflectance vs. Wavelength (nm)

- Violet: ~380-440 nm
- Blue: ~440-485 nm
- Cyan: ~485-500 nm
- Green: ~380-440 nm
- Yellow: ~565-590 nm
- Orange: ~590-625 nm
- Red: ~625-740 nm

Types of Papers:
- Fine art printmaking paper
- Fine art inkjet 1
- Fine art inkjet 2
- Gloss pigment
- Gloss dye
Spectral Curves of Papers (measured with a UV filter)

- Fine art printmaking paper
- Fine art inkjet 2
- Fine art inkjet 1
- Gloss pigment
- Gloss dye

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- Orange: ~590-625 nm
- Red: ~625-740 nm
Printer and Paper

- HP 130nr RGB printer (CMYKЛcЛm)
- HP 5000ps CMYK printer (CMYKЛcЛm)
- Fine art inkjet (1)
- Fine art inkjet (2)
- Fine art printmaking paper
- Photo Gloss Pigment
- Photo Gloss Dye

RGB Test chart
Measurements

- Gretag Macbeth Spectrolino with UV filter standard illuminant of D50 and 2° colorimetric observer
- Gretag Macbeth Profile Maker Pro
- Differences are calculated between the reference data from July 2005 and the most recent set of data
• A single print under glass against the wall.

• A single print in the open air against the wall.

• A pile of prints stored in an archival board box portfolio.

• A pile of prints stored in a plastic print bag and placed on a shelf, with a shelf above.

• A pile of prints placed on the shelf in the open air, with a shelf above.
Preliminary findings

• coloured samples when exposed to light begin to fade

• coloured samples when kept in the dark and are on the top of a pile begin to darken
Thank you