

Institute *of* **Physics**

Printing, Packaging and Papermaking Group

NEWSLETTER

May 2003

Editorial

Another year since the last newsletter and, although it may not seem so, a lot has happened. Mainly we have set a foundation for continuing the group on a firm and vibrant footing. With the help of our new committee members we have switched from the half a dozen half day meetings spread throughout the year to a few one or two day meetings organised with other groups or organisations. This has enabled us to reach a wider audience so we can bring the message of Physics in 3P's to both other areas of physics and non-physicists. So far this has been very successful with both good attendance and good quality presentations. In this calendar year alone we have had two meetings. The was the joint meeting with the electrostatics group on 'Statics in Packaging' on the 8th January 2003. and the "Second International Conference on: Preservation and Conservation Issues Related to Digital Printing and Digital Photography. A two day conference for conservators of print, photography and textiles. To be held at Heriot-Watt University that was on 24th and 25th March 2003 in conjunction with the IOP's annual Congress. See program details later in the newsletter for this and the other events in the last year. In addition we have started to give out an annual prize for the best paper published in the 3P's subject matter. Thus there has been much new work undertaken to produce a dynamic and successful group with the intention of spreading the word of Physics.

I made a recent visit to the GATF users conference on colour management in Phoenix Arizona. The reason I mention it is that not only that the size of attendance was very large at 300 but it was a very dynamic conference with much audience participation. It had a very wide range of attendees from photographers, pre-press operators, printers and print buyers with many of them expressing an opinion. Colour management, even if spelt incorrectly as color, is clearly a thing of great interest to the USA market now. For those who are not familiar with the GATF the Graphic Arts Technical Foundation is a member-supported, non-profit, technical, and education organisation serving the international graphic communications industries. (quoted from their web site at www.gatf.org). Their site has a few useful tools for those interested in colour management.

There are three things that will have a big impact on colour management and to those working in the graphics arts market this year and they are the expected arrival of a range of new standards. There are a group of new printing standards from the SWOP (www.swop.org) organisation to support the now familiar TR001 standard for printing conditions ranging from newspaper to high commercial printing, the arrival of PDF X/1 and PDF X/3 products to enable colour management workflows, and new standard print characterisation charts such as the ECI (www.eci.org) chart, already available, which will be a subset of the new ISO IT8.7/4 chart when it arrives. Which ones have the biggest impact in your market segment remains to be seen but with such a lot of activity I suspect there will be some effect upon you even if you do not use colour management. For those of you looking for further reading look at <http://www.npes.org/standards/cgats.html>.

Hope it will not be as long to the next newsletter.

Martin

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Reports on Meetings

**Selected Abstracts from Papers presented by students
of the London College of Printing**

Date: January 2002

Location: London College of Printing, Elephant and Castle, London

Making colour measurement instruments conform to graphic arts standards through a new interface.

Martin Spillane

The CIE defines methods of computing tristimulus values from spectral data that are applicable for a wide range of measurement conditions. However, for use within a given industry it is necessary to standardise on certain choices such as wavelength range and illuminant. The method of abridgement of matching function values recommended by CIE gives rise to greater errors than some other methods. These problems are addressed in ISO 13655 'Graphic technology — Spectral measurement and colorimetric Computation~ for graphic arts', but manufacturers of colour measurement instruments rarely conform to this standard or even make the methods accessible to the user. In this project an interface was developed to acquire spectral data directly from an instrument and enable the user to choose between different standard methods of computing tristimulus values.

**Image Fidelity on compressed video
Joe Bruton**

The project evaluates the difference in image capture quality between full bandwidth ITU R-601 Digital Betacam (130Mbps) video and the prosumer DV (25 Mbps) format. It examines how this difference in original capture quality acts upon perceived quality further down the image chain, when compression is introduced to facilitate exhibition on DVD

A catalogue of video clips was prepared and shot on both formats, then compressed via MPEG-2 to DVD. The original material and its compressed derivatives were presented in psychophysical test sessions. The subjective results were then correlated against basic objective measures so that conclusions could be drawn as to the efficacy of each capture medium.

Student Conference

Date: October 2002

Location: Institute of Physics Headquarters, London

On October 24th we hosted a postgraduate student conference from universities around the UK with an interest in Printing, Packaging and Papermaking. This was the first such event and we were very pleasantly pleased about the quality of not only the presentations but the interest from the audience. There was over thirty attendees who I believe found the day very interesting. Here are abstracts from the papers presented at the meeting. If anyone has any further interest in them then please either contact the individuals at the universities or contact myself, Martin Gouch, details after the editorial.

Visual Neutrals

Isidora O'Neill : London College of Printing

With new printing processes the grey balance values used in conventional offset printing are no longer valid. This is an investigation into determining the grey balance values needed for new printing processes which matches the grey reproduction used in conventional printing. A process was developed which matches the grey reproduction over 25 lightness levels. A total of 20 observers were used to ensure a high confidence level of 95%.

Artists' Characterization Target

George Hayhurst: London College of Printing

Accurate colour reproduction of fine art painting in print media can be difficult to achieve. This is because traditional scanning methods are best suited to photographic dyes rather than artists' colorants. Device characterization based on the standard ISO 12641 photographic target can result in poor reproduction of artists' pigments, as a result of factors such as metamerism. The objective of this project is to develop a target for input characterization of artists' watercolour to print media using target made from watercolour pigments.

The artists' characterization target consisted of 100 watercolour patches selected at approximately equal intervals throughout CIELAB colour space. Early results show acceptable results using the target.

Predicting the Colour of Half Tone Prints

Laura Iovine: Derby University - Colour and Imaging Institute

When making half tone prints with more than one separation on ceramic tiles the colour produced is affected by the overlap of the dots in a similar way to that with normal printing on paper. The aim of this work is to use the Neugebauer equations to predict the colour produced and therefore produce an RGB softproof and also enable the production of colour separations. Apart from the characteristics of the materials the main difference between normal printing on paper and printing on ceramics is that ceramics keep the dot size constant and vary the screen frequency to vary the density whilst printing on paper keeps the screen frequency constant and varies the dot size. It has been found that the use of Neugebauer-type models, that were developed for halftone printers on paper, also work well for ceramics. The use of Demichel's equation seems to predict the overlap area quite well, but an optimized system, of order $n=20$, can do better.

Characterisation of Press Felts

Michael Dowling: UMIST - Department of Paper Science/Voith Fabrics

Press felts and press rolls mark paper. Current analysis is carried out retrospectively on paper samples to identify the cause of marking. This causes costs and occasionally, loss of future business for the felt manufacturer. This project is aimed at developing a proactive and quantitative method of identifying the probable cause of felt marking by measuring pressure variation from felt impressions. A pressure sensitive material is required for this analysis. Carbonless copy paper (CCP) has been investigated as a pressure sensitive material and has been shown to be reliable and repeatable giving consistent results. Fast Fourier transforms (FFT), are used to separate the contributions from the periodic components from the impression, which can be quantitatively analysed. Image analysis algorithms have been produced which convert an 8-bit greyscale scanned image of the impression into a map of pressure. The pressure maps are statistically analysed for coefficient of pressure variation (COPV). The COPV can be used to obtain a quantitative performance index number. This number, with other quantitative and qualitative investigations, can inform felt designers and manufacturers whether the felt will have the propensity to mark paper before it leaves the factory.

Bentonites in Papermaking

Ahmed Rasheed: UMIST - Department of Paper Science

Bentonite is often used as a micro particle additive in RDF systems, however its properties differ from one source or location to another. Same as all natural occurring materials. These variations in properties are not yet scientifically studied. The current work is aimed to highlight those properties that are most important for the industry of papermaking

An investigation into engraving diamond wear

Andrew M. Clist: University of Wales Swansea - Welsh Centre for Printing and Coating

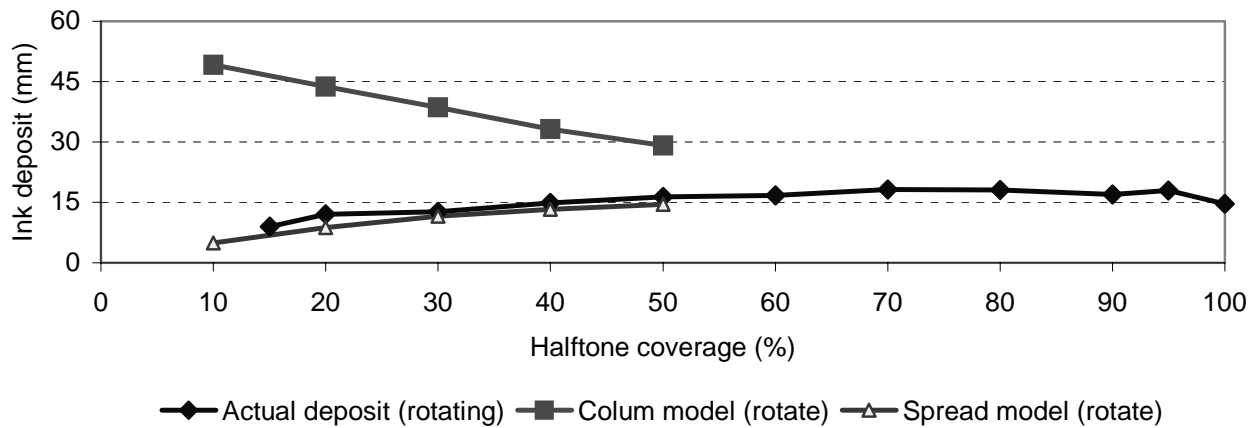
With the use of vertical scanning interferometry an investigation was conducted into the wear characteristics of diamond tipped engraving tools used in gravure cylinder manufacture. This has enabled the first 3D examination of the details of wear of the

diamond tip rather than the conventional shadow cast technique. The investigation has shown that the primary wear occurs over the first few uses with gradual wear after that. The wear is also uneven and effects edge sharpness as well as the angle of the surface. The technique permits examinations to be conducted on how the diamond tips are eroded throughout it's life.

An Experimental and Numerical Investigation into Ink Flow Within the Screen-Printing Process

Ian Fox: University of Wales Swansea - Welsh Centre for Printing and Coating

Screen printing is normally performed with the use of a blade to impact the screen and ink onto the substrate. This works look at the practicalities of using a roller instead of a blade and the mathematical models which predict the ink flow and printing characteristics. The use of rollers will reduce the friction inherent in the process and enable higher printing speeds. Typically the use of rollers in screen printing gives very poor results due to over inking. Increasing the mesh count to 150 from 120 resolves this problem and produces a result similar to blade printing. Experiments were conducted on roller diameter, the rollers able to rotate and the speed of printing. These were then compared to a mathematical model based upon a thin film hydrodynamic model which has parameter inputs of, Squeegee deformation, Non-Newtonian fluid effects, shear thinning effect, a porous screen, and an ink spread model based on the ink column model. Very good correlation was obtained between experimental and theoretical results over the lower print weights and high press speeds when the ink spread model was used.



Optical properties of polymer substrates for IMD

Chris Phillips: University of Wales Swansea - Welsh Centre for Printing and Coating

In the process of In Mould Decoration (IMD), used in the manufacture of items such as mobile phone covers, the surface texture and colouration is applied before the

material is moulded into shape. This investigation looks at the effect of the moulding process on the surface texture and colouration and the changes it imparts on different materials. Materials considered were Pure PC (polycarbonate), PC/PBT (polybutylene terephthalate) blend, PC/PET (polyethylene terephthalate) blends in 50/50 and 30/70 ratios, PC amorphous, PBT and PET semi-crystalline. The surface texture effects considered were gloss, surface roughness, transmission spectra and colour transmission and reflectance. A number of effects were recorded under the irradiation of IR and UV radiation which include the observations that Infrared causes texture loss in film but affects the appearance of 2nd surface print L* value only. Infrared also causes colour changes in blended films and depending on polymer ratio and composition, causes changes in L*, a* and b*. UV curing causes colour change in film a* and b* which can be reduced by using additives.

Prize Giving

Another initiative this year has been to start a 3P's prize. This will give a prize, for the present an annual prize, to an individual or organisation that has contributed a significant theoretical or practical application of physics in the areas of printing, papermaking or packaging. The winner is then awarded the opportunity to present a paper and receive a cash prize of £300. Look out for the call for papers this year later in the newsletter. The paper that won was by Jules Brammer of the London College of Printing, which was presented at the student conference mentioned above. Here is a summary of the paper.

The Effect Of Gloss On Colour

This project looks at how the presence of gloss affects colour perception and seeks to establish whether there is any correlation with colorimetric values. Two distinct, but related experiments were undertaken; the first was to establish whether the ISO/CD 15994.2 proposal for a metric for visual lustre correspond to that perceived; and the second was to evaluate how gloss affects colour appearance.

The first study combined Visual Lustre Number calculations, using a spectro-goniophotometer, combined with psychophysical assessments of perceptible levels of gloss. Visual Lustre Number calculations were then compared to a much simplified proposal which has been suggested to the Convener of ISO/TC 130, responsible for ISO 15994.2, by Sun Chemical Corporation Colour Physicist, Danny Rich. The psychophysical test took the form of a pair comparison where the observer was simply asked to indicate which of the patches appeared glossier. A total of 16 observers were used and the research showed that ISO/CD 15994.2 gives very good correlation with the visual assessment. Whilst the cross colour analysis results are still good, they are not as encouraging as the assessment of gloss with similar colours, this in some way is to be expected, but could have been improved by a better selection of colours for the psychophysical tests.

Danny Rich raised some concerns, the main one was that the simple gloss calculation gave as good a set of results as the Visual Lustre Number calculations, which was totally concurred with. It was also found that comparing rank order scores gave significantly better results than the direct measurements, which suggests that the relationship could, in fact be non-linear. It is certainly worth following this investigation further, to try to ascertain a simple model, which correlates perception of gloss as ISO 15994.2. Having gone through the procedures to measure gloss using a research goniophotometer. There are doubts as to the feasibility of engineering a portable instrument, which can produce measurement results consistent with ISO 15994.2.

In the second study, colour samples with very slight variations in CIELAB DE were psychophysically assessed, in three different viewing conditions to look at the issues concerning measuring and viewing geometries. The test took the form of a straight pair comparison, where the observers were asked to judge the DE between two patches; these were then compared to the colorimetric DE. The lighting conditions were, a viewing booth, a room fully enclosed with its normal lighting and finally in a room next to a window with the combination of diffuse and specular light. A total of 7 observers were used in this study. Due to the limited number of observers it is difficult to state positively about the findings. They should be treated as indications and areas that merit further investigation. There are many reasons for this; the first is the setting up of the modulus for the psychophysical experiment. This was later corrected for, but only with a limited number of observers, and in turn limited to only half of the available samples. The second is that the viewing conditions were not sufficiently different to determine a definite model.

The lighting booth results would indicate that the effect of flare had a significant effect on colour perception. The results obtained do point towards the idea that the level of gloss would seem to reduce the ability to judge differences in colour. The viewing conditions had an effect on colour perception; unfortunately the difference between 2 of the settings was not as marked as would have been liked. This resulted in no definite pattern, and any difference, is more likely due to the increased illumination in the room condition where the samples were next to a window, rather than the type of illumination. Ideally, this part of the experiment should be carried out in bright sunlight, with a highly specular component.

Second International Conference on:

Preservation and Conservation Issues Related to Digital Printing and Digital Photography.

A two day conference for conservators of print, photography and textiles.

Heriot-Watt University on 24th and 25th March 2003.

Organised by the Printing, Papermaking and Packaging Group of The Institute of Physics in collaboration with the London College of Printing.

As promised in my editorial we have the details of the major conference we are organising in conjunction with the IOP's annual Congress at Heriot-Watt university.

Session 1. The Concerns of Artists and Print Makers.

Digital Prints-An artists perspective.

Professor Paul Coldwell, Camberwell College of Arts.

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While traditional forms of printmaking could look back to tried and tested materials and procedures, the new digital technology advanced into unfamiliar territory. The fugitive nature of the early ink-jet inks and the limited range of suitable materials to print on, served to delay the acceptance of this new form of printing particularly amongst collectors and museums. It also presented issues for artists more familiar with working directly with materials, now finding themselves distanced from the making of the final output.

The new family of pigment based inks have largely resolved the issue of lightfastness and longevity while an ever increasing range of substrates present opportunities for the artist to be more physically involved with achieving a precise and individual surface. This presentation looked at the way some artists are challenging the singular use of inkjet prints, looking towards hybrids, and more physical uses of the media.

Conservation Considerations for Artists and Printmakers

Elizabeth Martin

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In late 1999, the Canon Gallery at the Victoria and Albert Museum exhibited three exhibitions featuring the work of prominent photographers of the 1960's. One of these was entitled " Triple Exposure ", the work of Ronald Traegar (1936-1968). The major part of Traegar's work was reproduced as IRIS prints. The author needed to

look at the longevity of imaging processes, especially those used by contemporary artists whose work the Museum acquires. To this end, since April 2002, the author has been shadowing a contemporary photographer. This is in order to see the process from start to finish: to witness the relationship between artist and printmaker and to understand the options and choices made in terms of resolution, inks and papers. The resultant conservation considerations were discussed.

'Development of a set of Recommendations for Fine Art Digital Printing'

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Art conservators and artists have similar interests but often a very different background, knowledge and approach to their work. Artists interested in using digital printing technology for expressing themselves are usually in need of consultation, mainly in terms of the technical realisation of their ideas. This is commonly the task of the print technician. The conservator may have different issues, however, that are not touched in the technical discussions. Experience has shown that, for a conservator, it can be extremely difficult to consult an artist in terms of choice of print technology or materials, considering the speed at which manufacturers are developing their products and the fact that relevant information is not readily at hand. Therefore the development of a set of recommendations might be helpful in guiding both the conservator and the artist towards an appropriate solution.

These guidelines must be generic enough to accommodate for changing printing technologies, yet be specific enough to allow for the determination of a printing process and the materials that suit both the aesthetic need of the artist and (if necessary) the material stability requirements of the conservator.

The set of guidelines proposed is a collaborative effort on the part of the author and other consulted conservators and artists.

Session 2. Materials, Processes and Permanence Issues.

Developments in Ink Jet Printing.

Nigel Sherman. Marconidata.

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Nigel presented a paper on the latest developments in ink Jet Printing.

Continuous Tone Digital Output Using **Archivally Proven** Printing Methods and Materials

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Whilst the primary focus for the preservation of digitally generated artwork in **hardcopy** has relied on the gradual refinement of digital printing devices, the reference points used for their improvement often appear to follow a strictly linear pattern **i.e** each development being an improvement over the last. The range of qualities inherent to print however, are vast and it is perhaps expedient to review pre-digital printing technologies from a broader perspective in order to gain a more comprehensive overview of what might be incorporated into digital print to create the ultimate in 21st century print quality.

With this objective in mind, the CFPR has focused its research on the often praised Nineteenth Century continuous tone print processes of collotype, photogravure and Woodburytype. This paper will primarily outline their unique qualities and discuss how they may be used to assist the production of contemporary, high resolution, conservable, digital print output. Particular emphasis will be given to the collotype medium emanating initially from Alphonse Poitvin experiments into photolithography during the 1850s.

The ability of the collotype medium to print in continuous tone without the use of a halftone screen enabled full colour images to be printed with far more fidelity than any of the subsequent standard CMYK printing processes still in use today. Because of its ability to print subtle modulations of tone using a fine random grain, rather than a mechanical halftone dot, more colour layers than the standard four could be used without any danger of creating unwanted moire interference patterns. A further advantage also lay in collotypes reliance on highly pigmented inks. These were far purer than modern offset litho inks, containing none of the synthetic additives now used to maintain maximum efficiency for high-speed commercial production.

As a testament to its quality, many prints still remain from the collotype era (circa 1880 to 1970) in perfect archival condition.

To re-tap this level of print quality for contemporary use, the Centre has spent some time in researching and refining a suitable interface between the traditional collotype process and the flexibility of digital technology. As a means of facilitating this hybrid of old and new, a collaborative venture between the Welsh ink manufacturer Cranfield inks, and the CFPR has been established to recreate a contemporary range of collotype inks. These allow extremely high resolution, digitally generated images to be rendered in pure pigment onto a range of traditional, Ph neutral, artists mould made papers.

This research has mainly been aimed at artists and print collectors who demand the ultimate degree of colour fidelity and archival stability from a limited edition original print. It also offers far more flexibility in producing colour work than the current, standard four colour approaches allow.

Although the research has been aimed at fine art production, many of the principles and standards achieved hold much value for incorporating into a range of digitally based, high quality industrial print applications.

The Durability of Digital Photographic Ink Jet Prints

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There are a number of output technologies available on the desktop for printing digital photographs. For the home user, ink jet is probably the most accessible. Ink Jet technology has made the greatest advances, over the last decade, towards producing high quality photos from digital cameras. The latest photoprinters are capable of printing images very similar in quality to those of traditional AgX-based systems. One weakness for the dye-based printers is the durability of the images. The image permanence i.e. light fastness, gas fastness (mainly ozone), humidity fastness and water fastness for images, produced using water soluble dye-based inks, is generally not as good as those obtained by the AgX process.

Several matched ink/media systems have recently been introduced, where the ink systems and the media have been optimised to improve image permanence. Epson introduced pigment-based inks, into desktop printers, to provide very durable images. While these can provide extremely stable images to light and water, which can be more durable than silver halide, there can still be some issues with ozone exposure over prolonged periods on certain photographic media types. The colour gamut can be slightly reduced compared to dye-based ink systems.

Most of the desktop printers use water soluble dyes in their ink systems. The durability of dye-based images on the swellable polymer coated photomedia tends to be very good. For the microporous media, images can also be quite stable however the prints are susceptible to gas fading particularly ozone. There is a lot of development activity in designing media which can provide much greater protection to the digital images.

The Preservation And Conservation Of Ink Jet And Electrophotographic Printed Materials

Deborah Glynn and Anthony W Smith. Camberwell College of Arts
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Since the early 1990's, digital printing has introduced a new way of working for the artist and photographer. Ink jet technology in particular, offers an efficient way of producing prints in diverse formats, possessing images with a variety of qualities. This type of work is already finding its way into national collections. However, there has been little comprehensive research published on its long-term durability.

This paper is a report of a wide-ranging investigation of the lightfastness of ink jet and electrophotographic printed materials. Inks sets from Seiko Epson, Canon, Lyson and Morgan (Iris printer) were tested on a variety of coated and uncoated papers. A range of light sources was utilised for the extensive programme of accelerated and natural ageing. The effect of radiation from specific wavebands within the visible spectrum on a selection of ink jet printed samples was also assessed. The findings of this investigation indicated that all of the ink jet printed materials tested are very sensitive to light and should not, therefore, be placed on permanent display, with a majority of the printed material showing one Just Noticeable Fade (JNF) after only 150 – 300 klx h. Most of the ink jet printed samples exhibited greater light sensitivity towards the shorter (violet/blue) wavelengths of the visible spectrum, than they did towards the longer wavelengths, with damage decreasing as wavelength increases. This relationship was not evident, however, with the cyan and blue printed samples, showing that light sensitivity is partly determined by the spectral absorption characteristics of the printed patch. On exposure to light, certain ink jet printed materials produced erratic fading rates. This phenomenon may be attributed to either the occurrence of photochromism or the disintegration of the dye particles within the ink layer. Further research will be needed to gain a proper understanding of the mechanisms involved.

Other factors also influenced the lightfastness of the ink jet materials, such as the type of paper employed for printing, ink jet concentration and the particular ink combination used. The electrophotographic printed materials were found to be more stable to light, although the yellow toner from some of the systems would show noticeable fading after about 65 to 325 years of permanent display (at 50 lux for 8 hours per day).

Samples of printed materials were subjected to a range of basic conservation treatments. The results indicated that ink jet print materials are very sensitive to all forms of aqueous treatments.

The Fading Characteristics of Dye Based and Pigment Based Inks on Artist's **Uncoated and Enhanced **Printmaking** Papers.**

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In consultation with John Purcell Paper London, Cranfield Inks Wales, The Faculty of Art Media and Design UWE, and support from Hewlett Packard's Art and Science programme, research is being undertaken into documenting how inks degenerate on a micro level. This paper will present the results.

Whilst accelerated tests provide some indication as to the life expectancy of a print, an actual real time test can give a more appropriate indication as to how paper and ink reacts and fades over time.

Furthermore the use of Blue Wool as a method for comparing fading characteristics requires a subjective analysis rather than an accurate recording or comparison of a colour.

A series of colour patch tests, using Hewlett Packard dye based and pigment based inks, are printed onto around 30 artist's handmade and photoenhanced papers. The first set is subjected to accelerated exposure, the second tests are individually wrapped in neutral paper and kept in a dry environment, the third is exposed to light approximately in a room that is similar to a working or gallery environment. During the research period, micro photography is used to document the effects of accelerated and natural light exposure and how ink changes or degenerates on a micro level. These patches are then measured using a spectrophotometer so that colour patches are accurately measured and compared.

Contributory aspects such as the chemical composition of the paper, whether the paper is photoenhanced, colour, weight are also taken into account. The suggestion is that rather than a reliance on blue wool, or a time length guarantee such as 'this paper will last for x years' alternative conservation parameters could be proposed. Given that most artists will use printmaking papers, a comparison over a range of papers, dye based versus pigment inks will be made, for example: based on certain lighting conditions an image printed with x inks on paper a) will last longer than paper b).

This research will have important repercussions as to deciding on the type of paper for digital printing for artists, museums or anyone wishing to increase the longevity and surface quality of the image.

Changes of colour and paper properties in ink-jet and laser prints during artificial ageing

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The aim of research was to evaluate lightfastness of chosen ink-jet prints compared to laser prints and watercolour paints

As conservators we were interested in popular printers used for more than several years. We tested different prints on different kinds of paper. Prints and watercolour paints were aged in "Xenotest 150 S". Changes to colours were determined by measuring the values of L*, a*, and b* in the CIE LAB and were found to be very substantial

In the second part of research we tried to assess the influence of printing process on paper. Prints and sheets of no printed paper were aged in climatic chamber.

No substantial impact of computer inks and toners on the pH of the studied papers was established, while the impact on durability properties (tear index, breaking length) was found to vary.

Session 3 Standards.

Standardisation Activity on the Preservation of Digitally Printed Material.

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A technical committee of the International Standards Organisation is currently working on preservation standards for digitally printed material. Previously this committee published a document on the test methods to determine light and dark stability of chromogenic photographic images. A companion document on ink jet, thermal dye transfer and electrophotographic images is considerably more complex. In addition to the effects of light and dark ageing, these images can be susceptible to the effects of pollutants (particularly ozone), water, humidity and fingerprints. Incubation tests for dark aging must be separated from the effects of moisture, and light stability tests from the effects of atmospheric pollutants. Tests methods must first be established for these properties and subsequently they can be incorporated into a specification standard.

The Development and Evaluation of new **Lightfastness Reference Materials**

Dr Samantha Pugh,

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Lightfastness can be defined as a measure of the stability of a coloured material to light or as the resistance of coloured material to fading. The ISO blue Wool standards for assessing lightfastness were introduced by the Society of Dyers and Colourists in 1934. In recent years, some of the dyes used to produce the Blue Wool standards have become unavailable. This has led to a requirement for a replacement set of lightfastness standards. A set of liquid inks were successfully formulated and applied to carton board. The compositions of the inks were varied to produce a series of inks that gave prints with a range of lightfastness values. Such prints were exposed to xenon arc light, alongside the Blue Wool Scale. The results of inter-laboratory ring testing was presented.

The Application of Colour Management System to Improve the Quality of InkJet Printing on Fine Art Paper

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There have in recent years been improvements in the quality of print achieved using large format inkjet printers with stable pigmented ink sets on fine art inkjet papers coated with an ink receptive layer. Increasingly professional photographers, graphic artists, printmakers and artists from all disciplines are using inkjet technology to produce prints.

Existing uncoated fine art papers can also offer a rich variety of substrates for inkjet printing. An identified problem is the colour variation between prints produced on coated and uncoated papers. This however can be remedied through correct linearisation and profiling. Colour management using ICC profiles is a very useful method to improve the quality of digital inkjet printing. The Centre for Fine Print Research, University of West of England and John Purcell Paper are currently undertaking research into digital printing on coated and fine art papers. The aim of the research is to develop a series of standard and bespoke ICC profile for a range of specialist coated and uncoated fine art papers, inks and printers.

This paper will focus on methods for the creation of profiles and an evaluation of both coated and uncoated fine art paper. A number of fine art papers with various weights and surfaces including 42gsm Japanese paper, 300gsm Somerset 100% cotton Mouldmade paper, coated inkjet paper including Somerset Enhanced and Hahnemuhle inkjet paper will be chosen as samples to make ICC profiles. The HP5000 large format printer with both dye and pigment (UV) ink, the Encad Novajet 63E with dye based ink, and a few ink jet printers will be used.

For ICC profiles making, black generation setting can influence the effect of profile directly. The settings of Total Area Coverage (TAC), Grey Component Replacement (GCR), Start and Max Black values are very important options for different substrates of paper. The above options, will be evaluated by comparisons of colour gamut, lightness, colour differences, and Psychophysical experiments. The results will be analysed and suggestions of suitable fine art paper chosen for inkjet printing and black generation setting for profile making was given.

Session 4. Digital photography and Textiles

Digital Cameras – Choosing and Using

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This paper will review the major decisions that must be made in order to choose a digital camera. The issues described will include the concepts of pixels, resolution and compression, as well as taking the picture, downloading the stored image, and viewing and editing the image.

A comparison will be drawn between conventional silver-halide based photography and digital systems.

Current Colorant Trends for Photograde Ink Jet Printing

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Silver halide photography is the benchmark for the highest quality colour prints. In the last few years ink jet has made rapid advances in photograde printing. Indeed, the best ink jet photograde prints are now considered by some to be superior to silver halide prints.¹ This paper examines the role that ink jet colorants, both dyes and pigments, have played in this achievement.

Development of Photo Quality Media for Inkjet Printing

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With a strong background in traditional silver halide technology, ILFORD Imaging has entered the Inkjet market as a significant manufacturer of media and inks for a range of applications. The main focus for media development at ILFORD has been photo-quality printing.

There are many factors to consider in media product development, from the choice of substrate and key components of the surface layers through to the design of the final coating formulation. These factors may all potentially have an impact on the stability of the prints produced. Some key considerations and interesting results were presented and discussed in this paper.

The Factors Influencing the Dark Stability of Inkjet Images

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ILFORD Imaging has over a century of experience in the factors affecting the stability of traditional silver and dye based photographic images. This depth of knowledge is now being applied to the stability of inkjet images in support of inkjet media and ink development projects.

In this paper the variables influencing the dark stability of inkjet images will be examined. Particular emphasis will be given to the factors affecting image fade due to atmospheric contamination. The nature of likely contaminants and the environmental factors that promote "dark fade" will be investigated.

The aim of this work is to generate a viable, realistic and reproducible test method to characterise different ink/media combinations for dark stability.

The Importance of the Balance of Light and Thermal Image Stability Effects in the Design of Photographic Color Paper

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In the “portrait and social” end-consumer environment, where the majority of images are used and stored for most of their life in low intensity illumination or dark conditions, it is extremely important to include both the light fade impact as well as the thermal fade impact in the design for print longevity. For silver halide materials, thermal fade typically goes warm, and light fade typically goes cool. The balancing of these effects can result in a print with less color shift and a resulting longer print life. Not considering both of these effects can, at best, cause confusion and unnecessary concern to end-use customers when stability predictions are made and, at worst, result in a paper that appears to have high stability, but in reality will not meet the stability requirements of the end-consumer. For extended longevity performance (greater than 100 years), the paper should be designed to be robust in both light and thermal applications individually, as well as balanced for minimal color balance changes, yellowing, overall dye loss, and contrast mismatches.

A Comparison of the Image Stability of Digital Photographic Prints Produced by Various Desktop Output Technologies

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Inkjet, thermal dye transfer, and electrophotography are among the technologies currently capable of producing digital photographic prints on the desktop. This presentation examines the various factors that affect the image stability of photographic prints produced by these technologies. In addition to accelerated light fade testing, we will also compare the dark stability of prints as a function of heat, humidity, and ozone.

Textile Printing - the Digital Route

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This presentation will explore the experiences of the speaker as both user and supplier of digital installations for textile printing. Consideration will be given to fabrics and dyestuffs and their performance chemistry. It will look at what has been learned and the implication of those experiences for production processes including limitations of materials. The interface between design and process were considered.

Call for submission

to the

Institute *of* **Physics**

Printing, Papermaking and Packaging Prize 2003

The award comprises a certificate and a prize of £300.

The Institute of Physics Printing, Papermaking and Packaging Group will present an annual prize to an individual or organisation that has contributed a significant theoretical or practical application of physics in the areas of printing, papermaking or packaging.

The winner will be invited to present their work and receive their prize at the Group AGM, (late 2003 or early 2004).

Applications for the prize should be submitted in the form of a brief summary of the work in English, by August 2003, to: Andrew Hanson, NPL, Queens Road, Teddington Middlesex, TW11 0LW. Enquiries regarding the award may be sent to this address or by E-mail to andrew.hanson@npl.co.uk

Future Meetings

SEVENTH INTERNATIONAL CONFERENCE ON WEB HANDLING

The Seventh International Conference on Web Handling will be held on June 1-4, 2003, at Oklahoma State University, Stillwater, Oklahoma, USA. Web handling is the engineering science underlying thin flexible sheet processes such as printing, drying, coating, laminating, slitting and winding. The meeting will provide a forum to exchange ideas, present technological advances, and discuss future directions. It will cover the topics of air support and conveyance; lateral mechanics, dynamics and control; longitudinal dynamics and tension control; measurement techniques; out-of-plane dynamics; sensors and signal processing; slitting and runnability; winding and unwinding; and wrinkling. The programme is now available on the website.

Further information is available from Ms. Linda Rogers, Conference Coordinator IWEB2003, Oklahoma State University, 512 Engineering North, Stillwater, OK 74078-5023, USA. Phone: +1 405 744 9217, Fax: +1 405 744 5369.

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Past meetings.

Now that the half day meeting program is no longer the main thrust of our activities I thought it would be interesting to review the history of these meetings so I have included a list of the meetings held in the 1990's. Thank you to Eddie Yeadon who took the time to put this together.

Institute of Physics 3P's GROUP

Date of Meeting	Subject	Venue	Total attendance	Number of IOP members
25-Feb-99	A Paper Miscellany	LCP	77	14
19-Nov-98	Digital Photography	LCP	59	10
15-Oct-98	Developments in Ink Jet Printing and Related Subjects	LCP	36	7
15-May-98	Physics of Coated Surfaces	ECC, St. Austell	23	10
19-Mar-98	The Impact of New Printing Technologies	LCP	22	12
19-Feb-98	Rheology	Portland Place	18	8
20-Nov-97	Physics in Modern Papermaking	Aylesford Newsprint	24	11
23-Oct-97	Computer to Plate	LCP	32	12
20-Feb-97	The Physics of Printing, Papermaking and Packaging	LCP	26	6
21-Nov-96	Surface Analysis Techniques	Portland Place	18	12
24-Oct-96	Digital Printing	Portland Place	64	11
25-Apr-96	New Developments in Holography	Belgrave Square	14	10
24-Jan-96	Optics in Printing	Belgrave Square	30	16
25-Nov-95	Seeing is Believing: Electronic Display Technologies in the Graphic Arts	Belgrave Square	37	13
26-Oct-95	Dimensional Stability of Paper	Belgrave Square	91	13
06-Apr-95	Roller Application of Fluids	PIRA	16	8
16-Mar-95	Computer to Plate	Belgrave Square	61	10
20-Feb-95	Advances in Printing	Belgrave Square	42	16
07-Dec-94	Fluorescence	City University	30	13
10-Nov-94	Print Quality and its Measurement	Belgrave Square	31	14
03-Mar-94	Colour Measurement and Standardisation	Belgrave Square	42	14
10-Feb-94	Rheology	LCP	56	13
09-Dec-93	Relationships Between Inks and Coated Surfaces	Belgrave Square	28	10

11-Nov-93	A Packaging Miscellany	Belgrave Square	12	8
07-Oct-93	Production Optimisation by the Use of Personal Computers	Belgrave Square	15	9
21-May-93	Structure of Pigment Coating Films	ECC, St. Austell	19	10
11-Mar-93	Non Contact Printing Techniques	Belgrave Square	24	9
11-Feb-93	New Developments in Contact Printing Techniques	Belgrave Square	33	14
03-Dec-92	Holography	Belgrave Square	13	11
12-Nov-92	Calendaring and Finishing	Belgrave Square	20	12
15-Oct-92	Hot Pressing	PIRA	8	7
12-Mar-92	Heat Problems and Solutions	Belgrave Square	9	5
13-Feb-92	UV Curing of Inks, Lacquers and Adhesives	Belgrave Square	27	9
05-Dec-91	Interaction of Packaging Materials and Machinery	Belgrave Square	23	8
07-Nov-91	Profile Control	Belgrave Square	19	10
10-Oct-91	Colour Measurement and Control	Belgrave Square	24	14
E. C. Yeadon March 1999		AVERAGES	31	11