

'THE PERFORMANCE OF THE PRINT'

An examination of aesthetic aspects of the materiality of early process contact-printed photographs and the application of contemporary digital technologies to selected nineteenth century techniques.

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ABSTRACT

The physical presence of contemporary photographs – whether as magazine, hoarding, wet chemistry, museum displays, inkjet prints or on-screen displays – is subordinate to the content of the image. However, resurgence of interest in the autographic opportunities of nineteenth century contact-printing processes has drawn attention to the material attributes secured through the varied ‘performance’ of the print and its affective potential.

This is a practice-led and practice-based project that explores the aesthetic saliency of the texture, tactility, reproductive qualities and materialities offered by selected ‘early’ photographic processes: albumen, carbon-transfer, cyanotype, photogravure, platinum/palladium and salt printing. The project has a triple focus. In the context of discourse on the language, syntax and automaticity of photography, it explores aesthetic impressions of materiality through vernacular descriptions of early processes prints. The lexicon offered by volunteer participants provides rich, imaginative, even ‘thick’ descriptions, that evidence nuanced awareness of, and response to, the physicality of photographic works. It is inferred that materiality colours, literally and metaphorically, the reading and affective impression of the work.

Changes in the commercial availability of resources required for early-process printing has encouraged the use of contemporary technologies for the production of inkjet printed negatives and the use of digital image capture and manipulation software. The second, practice-led, strand of this research investigates ways in which digital techniques may be adapted to provide enhanced authorial control over image qualities, using selected ultraviolet sources in combination with colourisations of inkjet negatives.

Within the context of discourse on the skin and the body, the third, practice-based, phase of the research is the production and exhibition of prints that respond to the vernacular lexicon of materialities and exploit the aesthetic potentialities of early processes. The works seek, through the 'skin of the print' to interrogate the skin and the body of the project's, mainly older, subjects.

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Author Declaration

I declare that during my registrations I was not registered for any other degree.
Material for this thesis has not been used by me for another academic award.

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Chapter One – Introduction

'The interest that art historians and others have in materiality has no inner logic that prevents it from paying closer and closer attention to a picture's materiality... The fact that historians and others do not do so demonstrates, I think, a fear of materiality. The "purely" or "merely" physical or material is conceived as a domain that is somehow outside of historical interpretation, or even outside of rational and critical attention'.

James Elkins (2008: 27).

It has been observed that we tend to *'look through'* photographs to their referent scenes paying little heed to the images as material objects (Elkins, 2011). As a physical channel of communication, the photographic print or screen display generally is treated as subordinate to the information it carries. Geoffrey Batchen (2000: 60) writes, 'in order to see what the photograph is of, we must first repress our consciousness of what the photograph is. As a consequence, in even the most sophisticated discussions, the photograph itself – the actual thing being examined – is frequently omitted from the analysis'.

With regard to what might be called 'fine-print' photography, the *physical presence* of the image-artefact stimulates relatively modest academic attention, particularly bearing in mind the very diversity of modes of photographic production. Historically, this wasn't the case for printmaker practitioners. Nineteenth century archives are pre-occupied with accounts and recommendations about the photographic definition, tone, gradation, colour, and longevity of the hundreds of emerging techniques and processes (Hannavy, 2008). But following the introduction of the halftone dot process, the industrialisation of image reproduction required standardisation of product and secured the commercial definition and popular acceptance of the physical qualities and presentation expected of photographic prints (Beegan, 2008: 286). This 'colonisation' of taste continues today with regard, for example, to the (over) saturation and resolution of digital imagery (Butzi, 2011).

Photographic images accommodate a number of actors who provide for the construction and interpretation of their 'meaning'. Roland Barthes (2002: 9) identifies key participants: the *Operator* (photographer), the *Spectrum* (target, referent or subject) and the *Spectator* (viewer). To these, I would additionally recognise the agency of display – curator, publisher or family archive, for example – in order to contextualise the viewer's encounter with the work. The contributions of the photographic author, the sitter, the spectator, and the gallery have been widely interrogated and are subject to continuing theoretical interrogation (Barthes, 2002; Elkins, 2007; Henning, 2006; Salkeld, 2014; Wells, 2002). The relatively recent *material turn* of enquiry (Barrett & Bolt, 2013; Breitback, 2011; Brown, 2001; Cleaver & Ruberg, 2014; Edwards, 2002, 2012; Edwards & Hart, 2004; Green, 2012; Rose & Tolia-Kelly, 2012) acknowledges the cultural significance and histories of objects as agents of value and meaning. However, the modulation of meaning articulated by the physical attributes of the print-as-objects – the particular aesthetic, the haptic of surface and material – appears not yet to have been fully subject to the same degree of theoretical or empirical interest. It is within this arena of the exigencies and aesthetic possibilities of photographic contact-print production that my research is centred.

The hegemony of industrial aesthetics and consequent reduction of product choice, combined with the ubiquity of screen display, contributes to the immateriality of the *print-as-thing*, promoting standardised realisations of photographic imagery. This research project seeks to draw back something of the veil from the print artefact – looking closely at surface texture, tonal differentiation, resolution, tactility and haptic visuality as objects of enquiry, using my practice of nineteenth century contact-printing processes as case-studies for investigation.

1.1 Research aims

This research project is '*practice-led*', concerned with the character of 'early' (that is,

nineteenth century) photographic contact-printing. Its outcomes include technical developments in printmaking practice, quantitative assessment of print attributes and qualitative evaluation through viewers' responses to print materiality. It contributes new knowledge with operational significance for contemporary use of early processes. 'Practitioner-based' research is an integral element of the project also, where investigation of the aesthetic potential offered by the materialities of print production is articulated as creative work (Candy, 2006). I act, therefore, both as researcher and as printmaker practitioner, exercising and reflecting upon my own practice. My project has four complementary research aims based upon the central hypothesis that print surface and materiality have aesthetic potency to which viewers respond and which adapted digital technologies may exploit:

- Aim 1. To consider discourse on the production of meaning – syntax and language – in photographic images, with specific reference to the contribution of surface and materiality, situating the research within a historical and cultural contextual overview of representations of the skin, body and person.
- Aim 2. Based upon quantitative assessments of print properties, to investigate the incorporation of contemporary digital technologies with 19th and early 20th century photographic processes in order to secure the enhancement of print surface, tonality and opportunities for authorial gesture.
- Aim 3. To explore viewers' aesthetic appreciation of the materiality of prints produced using selected nineteenth century photographic contact-printing processes
- Aim 4. To produce an exhibition of photographic prints that explores the aesthetics of surface, texture and tonality in the representation of skin, body and person, in the main using older subjects.

My investigations are broadly based. They incorporate a multi-disciplinary enquiry into the status of photographic representation and the *syntax* or *channels* of its articulation and,

within that context, a central concern with the aesthetic potential of the surface and materiality of the print, how its 'performance' is perceived by an audience and how it might inform the production of print-works depicting the skin, the body and the person. The investigations explore how the qualities of such processes, in conjunction with contemporary digital technologies, may be adapted to exploit the authorial potentialities of print tonality, tactility and surface. In respect of early photographic contact-printing processes, the project aims are articulated as specific research questions:

The first practice-led research question in respect of the contribution of digital technologies to these early processes is:

What scope is offered for authorial manipulation and control of production with regard to print materiality, tonality and definition?

The second practice-led research question is:

How do viewers describe their responses to and appreciation of the material attributes of photographic prints?

In respect of my practice combining digital technologies with early photographic printing processes, the primary practice-based research question is:

How may the creative exploration of the material attributes of prints support the articulation of visual 'thick description' (Geertz, 1973) of portraiture subjects and the form and texture of the body?

1.2 Structure of Report

Accordingly, the presentation of the research investigations is organised within the following broad areas of enquiry:

- the '*languages/syntax*' of photographs and treatments of skin, body and person
- the quantitative and qualitative '*presence*' of prints
- the adaption/incorporation of digital technologies, and
- the creation of works.

This introductory chapter sets out the context and aims of my investigations. The second Chapter outlines the project's methodologies and research methods. The language, syntax and representational status of photography are reviewed in Chapter Three, which provides the theoretical and methodological basis for the investigations of the attributes of selected contact-print processes (considered further in Chapter Five). Chapter Four and its Appendix contextualise the practice-based production and exhibition of my works within a review of portrayals of the skin, body and persona, that serves also to situate the overall research project within its creative milieu and reflects on the contribution of the subject. Chapter Five and its Appendix outline historical and technical aspects of nineteenth century photographic contact-printing processes, and considers their '*material-syntax*' and physical attributes. Chapter Six and Appendix continue the empirical examination of print-materialities and demonstrates the adaptations to process secured through the combination of digital and traditional technologies. Chapter Seven considers the vernacular lexicons offered by Response Group respondents to describe their aesthetic appreciation of different print processes, and relates these to the quantitative analyses of Chapter Six. Chapter Eight offers a discussion of the research and a concluding assessment. The Appendices provide important further consideration of the empirical and theoretical investigations and reflections on my developing practice.

1.3 The context of the research

Notwithstanding current commercial standardisation, each and every photographic image, be it modern or ancient, digital or analogue, is necessarily a presentation – a performance – that could have been executed differently.¹ Even in the case of screen presentations or prints of digital image files where, although routine processing may be controlled according to the

¹ I would exclude daguerreotypes, X-rays and some Polaroids from this generalisation, but not from the claim – applied to all photographs - that their original productions are themselves performances (Shusterman, 2001).

'default' settings of the equipment, both the specification of the defaults and the decision to accept or vary them are authorial expressions of choice. The single term 'photograph' elides *recording* with *presenting*, the *script* with the *performance*. Ansel Adams articulates this distinction. 'I have often said that the negative is similar to a musician's score, and the print to the performance of that score' (Adams, 1983: 2). 'Photographers are, in a sense, composers and the negatives are their scores' (Adams, 1985; 305). Analogous with the playing of an instrumental piece or theatrical staging, the articulation of a positive photograph image requires a selective and thus necessarily interpretative process that is separate from the original authorial composition and production of film negative or binary file. In other words – no performance, no photograph. Bruce Gronbeck (2009: 133) writes, 'changes in the materiality of photographs can alter in highly significant ways the physiological-cultural or psychological-historical processes of viewing them. The images themselves become different images when materialised in different ways'. Ansel Adams' technical 'production directions' for the prints in his lyrical series on Yosemite Park provide a comprehensive illustration of this point (Adams, 1989). Elizabeth Edwards confirms this view.

'Throughout the history of photography the visual properties of the surface of the image have depended on the material. They have exceeded the direct indexical visual use, and created, literally and metaphorically, another dimension to the image... Material forms create very different embodied experiences of images and very different affective tones...' (Edwards, 2002: 68)

Each mode and manner of execution of the 'performance' of the photograph stamps a particular and recognisable quality and character upon its output – described, in another context as the '*imago*' (Bedos-Rezak, 2011). Whilst digital technologies have now been widely if not universally adopted over the last two decades, the opportunities for the digital origination, manipulation and production of fine prints have been accompanied by a resurgence of artistic interest in nineteenth century photographic printing techniques. Over the last two decades of commercial development, research into the digital capture and

manipulation of images, and the technical surface properties of modern substrate coatings and ink deposition, has helped shape a mass-market consensus about the presentational qualities required of images – for example, colour saturation, contrast and resolution (Inoue *et al.*, 2000; Pedersen M. *et al.*, 2011; Tchan, 1998). In comparison, earlier contact-printed and hand-coated techniques, such as photogravure, platinum or carbon-transfer, provide for markedly different output, where the contribution of the ‘print-as-artefact’ to the cognitive and aesthetic response of the spectator is potentially more open. Through the extensive possibilities of surface manipulation and the choice of substrate and inks/pigments, these older processes are utilised by some contemporary photographic printmakers to allow more extensive authorial intervention and gesture. As Ruth Pelzer-Montada’s states, ‘today – unlike in the heyday of modernist painting – the formerly mechanical surface of the print can appear...rich in presence’ (2008: 78).

My printmaking interest and the focus of this research lies with early photographic contact-printmaking processes and representations of the body and persona. Techniques and technologies developed between the 1840s and 1880s were primarily craft-based. They provided amateur and professional photographers, and the growing numbers of commercial printers, with extensive opportunities for authorial manipulation of the material image. A wide range of processes was available, each imprinting a unique signature on its paper or glass substrate. In consequence, photographic prints exhibited a variety of physicality and character that is less evident with contemporary industrial productions. Popular ‘fine-art’ continuous-tone printing processes in the nineteenth century included salt, albumen, cyanotype, carbon transfer and platinum, and intaglio-gravure and collotype (where perhaps ‘near-continuous tone’ might be a more accurate technical description). These early processes produced prints with tonal ranges and monochromatic palettes that differ quite markedly from current silver-gelatine and commercial techniques. They traditionally utilised

substrates offering a wider variety of surface texture and optical brightness than is commonly and commercially employed today for digital output. The mode and attributes of each type of production were evident in the materiality of the surface, which gave, as it were, a distinctive 'visual voice' or 'syntax' to the print-artefact, colouring – both literally and metaphorically – the readings and presence of the object.

I am attracted to the expressive potential of these early photographic techniques, particularly as the lack of commercially available materials necessitates considerable handwork, with all its vagaries and benefits. Their exceptional 'volume, opacity, tactility, and physical presence in the world' (Blatchen, 1997: 2) allowed this research project to explore the performance potential and aesthetics of the material attributes of nineteenth century printmaking processes. I believe the repertoires of the printmaker/photographer can be extended, by the integration of these processes with contemporary technologies, to exploit the cognitive and affective audience response occasioned by the physical properties of the print-as-artefact. Applying this to my professional practice and investigations, I have chosen to photograph and make prints of the skin, bodies and persona of, in the main, older subjects who offer a rich visual experience that I find complements well the processes through which I attempt their portrayal.

Portraiture has a very rich theoretical and cultural hinterland. I situate my creative exploration of print materiality, therefore, within the context of historical and contemporary theorisations about the nature of portrayals of the skin, the body and the person and about the visual syntax and representational status of photography. In this way, I seek to ground both my empirical investigation of the surface and physicality of the print upon a review and understanding of theoretical analyses of the photograph and the portrait. My developing professional practice is informed by these reviews and is intended to reflect something of

contemporary theoretical ambivalence about ‘authenticity’ – that of the photograph, of ‘the self’ and of her/his pictorial representation (Van Alphen, 1997).

1.4 Research through Practice

Though a relatively recent development, research in the arts conducted and reported through professional practice and the creation of works has become an academically acceptable route for the investigation and articulation of ‘new knowledge’ (Frayling, 1997). A distinction is commonly made between research that is ‘*led by*’ or centred in some empirical, historical or theoretical aspect of the production of creative works, where ‘new knowledge’ broadly is descriptive and explicative of process and its context, and research that is ‘*based*’ or articulated by acts of creative expression where ‘new knowledge’ resides in and is communicable by the works themselves (Candy, 2006). Carol Gray (1996: 3) defines this as, ‘research which is initiated in practice, where questions, problems, challenges are identified and formed by the needs of practice and practitioners; and secondly, that the research strategy is carried out through practice, using predominantly methodologies and specific methods familiar to us as practitioners’.

1.4.1 ‘Practice-led’ enquiries

The *practice-led* strand of my research has two main themes. I examine the effects of techniques of inkjet-negative production of the negative substrate on the visual and surface characteristics of contact prints (Chapters Five and Six). My hypothesis is that the tonal discrimination, acutance and tonal range realised with contact-printed early photographic processes can be influenced by the nature, colourisation and digital manipulation of inkjet negatives and by the wavelength and other characteristics of the ultraviolet light exposure. I establish techniques using inkjet negative production to optimise the reproduction qualities of contact printing processes.

Secondly, I consider the potential of different types, or materialities, of contact prints to mediate viewers' appreciation (Chapter Seven). I hypothesise that '*readings*' of prints – that is, what might broadly be called the aesthetic and narrative responses by viewers – will be shaped not by image content and authorial gesture alone, but also by the haptic qualities of print surface and materiality. Vernacular descriptions of print materiality – their subjective assessments – are made by members of '*Response Groups*' (volunteer, lay participants) and related to the visual and tactile character of the works. Their lexicon articulates the saliency of material attributes and provides an indication of the imaginative breadth and colour of the viewers' engagement with the prints.

1.4.2 '*Practice-based*' enquiries

The findings of my *practice-led* explorations of contact-printing processes and the narratives and lexicon of audience response to those print materialities and surface may be evaluated through replication by other practitioners. The epistemological credentials, however, of the *practice-based* elements of my research depend upon the experiential. Supported by theoretical and historical contextualisation, the 'communicative potential' of my works, offers a more sensory articulation of 'knowledge'.

Suzanne Langer (1957) made a helpful distinction between the discursive language of science and the non-discursive 'language' of artistic expression of feeling and unmediated sensory experience. Claims for 'new knowledge' about the processes of creative production – *practice-led* research - invariably take the form of written reports where they may be assessed in relation to prior theoretical or empirical understandings. *Practice-based* claims for 'knowledge' articulated as creative works may be more experiential. Peter Dallow (2003: 55) describes the *practice-based* research symbioses of investigation, production and reflection.

'Research by creative practitioners through their own arts practice is where the process of making, producing or creating cultural presentations, and the exploration and transformation which occurs in the process, is taken as an act of research itself, where knowledge is gained in the creative act, and can be directly attributable to the creative process. This 'emergent' knowledge may be abstract or cognitive (theoretical) knowledge, as well as practical knowledge gained in and from the 'doing', from the application of a developed creative methodology'.

In and of itself, a photographic art-print embodies neither knowledge nor meaning and has no inherent value (Berger, 1982). The 'performance' – that is, the *production* of the photograph, including the design and method of its realisation and its display as 'a print' – is informed by interpretative possibilities that the author/distributor wish to see inscribed within the work. In turn, the 'performance' – that is, the *visual, affective and cognitive apprehension* – of the print by its audience, in the sense of the varied ascriptions, narratives and affective relationships constructed around its cultural potentialities, is the site where the artefact's meaning or knowledge is generated and exchanged. Accordingly, the *practice-based* works created through this research offer a new contribution to the discipline insofar as the prints generate aesthetic and culturally interpretative potential in their origination and production and their consequent 'performance' by the viewer.

My use of 'early' techniques, distancing somewhat the realism of the photograph as index, contributes to the materiality of the artefact. In my practice, empathetic awareness of the corporeal presence of my subjects is engaged through presentations of the envelopes of their skin that heighten the haptic of surface, texture and dimensionality, complementing the sitters' explicit complicity in display. I look, in the production of my works, to the theoretical contextualisations of my practice of portraiture and printmaking to illuminate and to extend the domains of understanding and experience within which depictions of the person and the body offer richly layered and cultured accounts of meaning and value. My Practitioner's Statement is included within Chapter Four. In this regard, my contribution to *practice-based* knowledge rests on the narrative compositions of my works and on their resonance within

and between these fields of enquiry. I wish to offer the 'new knowledge' of my works as resource, an aesthetic and affective potential, not a proposition, a process of exploration of interpretation and affectation. The outcome of this strand of the research is an exhibition of works. Photographs of some of these works are shown in the Appendix to Chapter 8, though the low resolution reproductions provide little experiential or haptic evidence of the materialities of the exhibited pieces.

1.5 The performance of photographic prints - process

In the early development of photography, whilst the sensitivity of silver salts made them the inevitable choice for the preparation of negatives whether on paper, glass or celluloid, concerns about their susceptibility to environmental degradation prompted a search for light-fast and permanent positive-print processes. *Salt-prints* – so called because the light sensitive coating is produced by applications of common salt solution (sodium chloride) and silver nitrate to deposit silver chloride – and their albumen coated derivative, were extremely popular in the last half of the nineteenth century. Iron and chromate sensitised processes – platinum and carbon prints for example – were the first to offer printed photographic images of reliable longevity. These and other early printing processes require the exposure of photosensitive substrates to light, sandwiched in direct contact with an image carrying transparency – usually a film or paper negative. With the exception of silver-based chemistry, most early processes require such high levels of energy in the ultraviolet spectrum, either from the sun or more recently from special UV lamps, that printing through optical enlargers is not possible. In consequence, these 'contact' prints are always the exact size of their originating negative.

The light sensitivity of chromate salts, initially noted in the late eighteenth and early nineteenth centuries, was exploited relatively early in photographic development to

insolubilise colloid matrices, such as gelatines, albumins and gums. Three key families of chromate-processes were developed: **photogravure** (initially Fox-Talbot, 1850s, and Klíc, 1870/80s), **collotype** (Poitevin, 1850s) and carbon transfer or gum bichromate **pigment** printing (Poitevin again, Pouncy late 1850s, Swan 1860s and Woodbury, 1860s). These methods secured stable, lightfast images through the use or substitution of (more or less) inert inks or pigments to replace silver salts and formed the bases both of commercial printing and individual artistic production (Crawford, 1979).

Based upon iron compounds, **platinum** printing was initiated in the 1830s through separate developments by Dobereiner and Herschel and Hunt, and offered longevity and protection against environmental degradation. Following work by Hunt and by Pizzighelli that allowed for the consistent preparation and development of manufactured papers, it became practicable and popular with photographic artists in the 1880s and well on into the twentieth century. Unlike collotypes and gravures however, the medium lacked the potential for mechanisation and never formed the basis of serious commercial printing (Crawford, 1979).

Both siderotype (iron) and colloid based processes were acclaimed not only for their stability and, gum prints excepted, fidelity of reproduction, but also for their individual aesthetic qualities. Platinum prints are admired still for their particular delicacy and gradation in mid and high tones. The process is sensitive across an extended density range, enabling it to respond well to negatives that are not unduly compressive in their recording, and by variation in chemistry and humidity it permits manipulation of contrast and colour. In short, it offers opportunity for authorial intervention in the pursuit of artistic realisation. It was embraced by nineteenth century '*pictorialists*' then by '*straight photographers*' of the Weston/Adams schools and, later, notably by Avedon and Penn (Marien, 2002).

Dichromated colloids rapidly became the medium of choice of the late nineteenth century printing industry for image reproduction, allowing offset printing of text and picture

combined through the use of screening techniques that expressed gradated tone and line as dots of varying size and, later, colour. For a period, *Woodburytype* and *collotype* continuous-tone productions were strongly favoured for their definition and accuracy of reproduction, but they gradually lost out commercially as Woodburytypes required to be ‘tipped in’ to the separately printed pages of books and magazines and collotypes could not be accommodated with type in the same form. However, until the 1920s and even into the 50s and 60s, collotypes and photogravure and pigment prints were the vehicles for both individual ‘fine prints’ and art editions of modest size.

The sensitised colloid matrices of these processes are able to secure extremely high definition and are still used currently professionally for holographic and some astronomical imaging. For the photographic artist they offer extensive choice of colour and opportunities for hand manipulation. Photogravure processes provide the texture of the pressed image, carbon or pigment prints allow for some element of bas-relief and collotypes give almost infinite opportunities for over-printing and control of colour. Although Woodburytype printing is no longer possible because of the lack of the hydraulic presses required to imprint the gelatine matrix on to the lead die, the other early contact processes offer a portfolio of media for artistic photographic reproduction of quite extra-ordinary capability and opportunity.

1.6 My practice of print processes – rationale

The use of digital negatives for contact-printing avoids the analogue constraint on image size and facilitates ‘performances’ of the print more finely attuned to the photo-sensitivities of the process than is easily possible with the use of film. Digital cameras provide opportunities for rapprochement and professional intimacy and spontaneity with sitters that may be more awkward with large format cameras given the close attention that their handling requires. It

is my experience that digital technologies, carefully incorporated, can enhance the authorial potential of the early photographic techniques and the performance of the works. An apocryphal criticism of printmakers is that they obsess about process and make a fetish of the artefact. Whilst I hope this is not applicable in my case, I admit to a creative enthusiasm for the 'feel' as well as the appearance of works on paper, for their weight, texture and the very 'objectness' of their material existence. Djonov & Leeuwen (2011) describe this physicality as a potent semiotic resource for meaning-making and in my practice I have found this to be true – 'older technologies of print yield a tactile, "fleshy" surface in comparison to the mean slimness of the digital print' (Pelzer-Montada, 2008: 78). My interest in making prints expressive of the age and texture of the skin and the bodily experience of the sitter is well served by these early processes, but it requires the viewer to determine whether my practice is merely nostalgic and derivative of a photographic *pictorialism* long exhausted of creative potential, or authentic in an affective intimacy with the presence of my subjects.

Chapter 2 Methodologies and Methods

'Ideas and positions do not supersede one another, or inter-act and synthesise in clear dialectical fashion. Rather we witness an accumulation of models and critical perspectives which sort of fold into one another, re-emerging in shifting formations'.

Liz Wells (2002, 3)

My interest here lies with the creation and sensate experience of the photographic print. The central proposition of the research – that the material performance of the print matters – requires interrogation with respect to all three elements: *'materiality'*, *'performativity'* and *'mattering'*. These enquiries are situated at the juncture of sensitometry, photography theory, aesthetics, psychology, cultural and art history, phenomenology and visual and communication studies, and draw from across that breadth of narrative and discourse. This multi-disciplinary research is purposely so conceived – undertaken as practitioner making new works that are expressive of a developing appreciation of the salience of print materiality, and articulated with technical clarity and innovation.

2.1 Methodologies

I do not conceive of photography as a unified discipline of practice or mechanics. Rather, I consider *'photography'* as a term descriptive of varied processes of divergent purpose and visual product, whose fundamental commonality lies only in recording the energy of photons for their subsequent second generation (or third or fourth) articulation as hard copy prints or digital screen-imagery. That the physical attributes of photographic prints have occasioned only modest critical enquiry is unsurprising given that the indexical status and allegedly *'transparent'* content of the photograph can and does divert attention from the particularity of the printed re-presentation, which rests as a subordinate matter (Değirmenci, 2015; Lopes, 2003; Waldon, 2014; Walton, 2008). Discourse on the causal autonomy or *'mind-independence'* of photography (Philips, 2009) circumscribes the arena within which its aesthetic possibilities are contained (Scruton, 1981). Space here is contested, but has been

claimed for a syntax of apparatus and process (Crawford, 1979), which is of particular interest for this project in respect of the variety of early printing methods, for authorial intention and direction (Lier, 2007; Phillips, 2008), and for the denotive and connotive agency of material (Barrett & Bolt, 2013; Kress & Van Leeuwen, 2006; Rose & Tolia-Kelly, 2012).

Conservators and industrial manufacturers have extensively researched the stability, longevity, composition and deterioration of photographs and their coatings (Bandyopadhyay *et al.*, 2001; Chovancova *et al.*, 2004; Ishii, *et al.*, 2001; Larsson *et al.*, 2007; Lee *et al.*, 2005; McCabe, 2005; Vickman *et al.*, 2004). Critics, philosophers, photography theorists, art-historians and psychologists, amongst others, have explored the uses and meanings of photographic imagery (Barthes, 1981; Bazin, 1971; Berger, 1989; Bolton, 1989; Burgin, 1982; Crowther, 2009; Elkins, 2007; Fried, 2008; Krauss, 2010; Maynard, 1997; Parry, 2011; Solomon-Godeau, 2007; Tagg, 2009; Van Gelder & Westgeest, 2011). The potential saliency, for viewers, of the materialities of photographs has not, however, yet found a secure methodological or conceptual home within any discipline. It is this material variation in articulation – not the social history of the artefact (Edwards, 2012) or its *objectness* (Breitbach, 2011) – that is the particular interest of this research.

Quantitative framework - measuring

Photographic sensitometry underpins my quantitative evaluation of prints and investigation of tonal differentiation (Burton, 1887; Kipphan, 2001; Proudfoot, 1997; Russ, 1995; Stroebel *et al.*, 1986; Todd & Zakia, 1981). Industry 'quality control' protocols inform my assessment of image attributes such as resolution and contrast (Cerosaletti & Loui, 2009; Keelan & Cookingham, 2002; Lindberg, 2004; Ming-Kai, 2009; Pederson, 2002; Petterson, 2005). Whilst technically complex in many procedural and definitional regards, qualitative measurement of the material attributes of prints does not articulate the breadth of

conceptual formulation and theoretical sophistication demonstrated by the epistemologies of photography. The *practice-led* strands of the research touch only tangentially on the cultural significations of photographs *qua* photographs (Batchen, 2011; Kelsey & Stimson, 2008; Tagg, 2009), though they draw heavily upon discourse regarding their indexical status and automaticity (Barthes, 2002; Elkins, 2007), and their language or syntax of representation (Batchen, 1997), with regard to potential autographic contribution to the preparation of prints. As Jae Emerling writes (2012, 7), '[Photography] was never a natural, straightforward, representation void of artifice. This myth is only an effect of discourse'.

Qualitative framework - 'mattering'

There is a very broad range of literature that examines the formation and nature of aesthetic response – psychological, neurological, philosophical, phenomenological and art history, for example – but there is no evident common understanding of *aesthetic* sensibility or judgement, the terms themselves are problematic (Fenner, 2003; Curry *et al.*, 2014; Gregg & Seigworth, 2010). Very little ground is shared between psychological attempts to determine the physiological bases of aesthetic response (Khan & Vogel, 2012) and critical theorists' accounts of the ascription of cultural values (Tormey, 2007). Philosophical interrogation has long retreated from essentialist attempt to define *beauty* or *art*, but been unable to provide conceptual or linguistic clarity about what is entailed in '*seeing with feeling*', or '*hearing with feeling*' for that matter (Prinz, 2014). The structure of the brain and visual system, the socialisation of the viewer and the attributes of the artefact remain to be incorporated within an holistic account of how and why the very act of just looking at something can please us.

Considerable paradigmatic distance is evident between what might be described as the 'ahistorical naïvity' of some psychological accounts of aesthetic appreciation and the disregard of physiological and neurological function exhibited by many art-historians and art-

critics. Psychological experimentation has sought, if not some form of 'deep structure' of the brain (*pace* Noam Chomsky, 1969), then some physiological and neurological patterning that is responsible for aesthetic sensibility. Indeed, empirical psychological studies have demonstrated in the laboratory significant regularities in preferences for pictures that follow, for example, the *rule of thirds*, or the *golden mean* or other artistic 'laws' of composition, colourisation and pictorial harmony (Pratt, 1961; Shimamura and Palmer, 2012). Underpinning assumptions, here, are that appreciation of art is shaped by the structure and functioning of the human brain and visual system, and that there are physiological or neurological determinant routes of aesthetic response (Martindale, 1990).

In contrast, social theory approaches find the locus of aesthetics in cultural structuration and narrative and, in the main, are uninterested in the physiologies that process or articulate this response. Aesthetic appreciation, it is held, is socially contextualised, both with respect to the artefact and the respondent, and it is this precisely this context that psychological studies disregard (Bloom, 2013). Schools of theory in the humanities – phenomenological, feminist, aesthetic, psychoanalytic, post-structuralist, critical, queer, semiotic or new art-historical, for example – offer constructions of the world of distinctive paradigmatic cast, lexicon and narrative exegesis. Circumscribed within each framework of definitional assumption, discourses exhibit subtle logic of deduction and explication, ascribing and thus inscribing cultural purpose, value and relationship. Theory not only creates description, it expands and diversifies the cultural capital of experience and comprehension. It becomes part of the world it observes, for linguists and adherents it is lived-experience. This is not to say that empirical information is irrelevant. Construction and selection of evidence, referencing features of cultural experience, is *the* narrative backbone of Theory, it is authentication and persuasiveness as an account of the meaning, purpose and hegemony of social order.

2.2 Practice-based productions

The *practice-based* research strand of this project is strongly informed by the cultural significations of photographic imagery – in this study, those of the skin and body. The development of my image making and professional printmaking practice is influenced by discourse on the inscription of social identity and value (Benthein, 2002; Blaikie, 1999; Browne, 1998; De Beauvoir, 1970; Schilling, 2003; Townsend, 1998), and by contemporary conceptions of representation of the ‘autonomous’ individual (Comar, 1995). Whilst earlier formalist accounts of photography bear strongly upon the aesthetic implications of ‘the thing itself’, the frame, detail, time and vantage point (Szarkowski, 2007), a good deal of work has been published since the 1970s articulating critical theorist, semiotic, postmodern and feminist analyses of the identity and meaning of imagery. This has accompanied the international embrace by major museums and galleries of new photographic art movements, predominantly those that reflect upon iconological and indexical conventions and the nature of the medium itself (Fried, 2008). Associated discourse in art history has re-interpreted the practice and function of portraiture and the role played by pictures in the inscription of cultural values and social identity and in the exercise of authority, sensitising audiences to the construction of practice and preconception and drawing attention to the gaze of the viewer or voyeur. There is no paradigmatic consensus on the mimetic or artistic ‘authenticity’ of portraiture and depictions of the body (Van Alphen, 1997). Portraits are manufactured and ‘used’ within circumscribed cultural conventions of perception and representation. The image and its display, it has been argued, provide stimulus only – meaning, value and affect are held to be constructed (West, 2004).

At the centre of much current debate about portraiture lies a contemporary presumption that the experiential realities of human identity, understanding and interaction are social constructs shaped by, and lived wholly within, the language, semiosis and mores of civic,

political and economic hegemonies. The production and maintenance of social conventions of depiction is central to discourse on visual culture, embracing three foci of investigation: the production process, the image/object and the audience (Elkins, 2003; Rose, 2007; Sturken & Cartwright, 2009). Contemporary tools of interrogation – including critical theory, compositional interpretation, haptic visibility, content analysis, semiology, psychoanalysis and discourse analysis – are of direct relevance to my empirical research where they offer access to the social and individual construction of meaning, and to my professional practice also where they situate cultural representation of the body and the gaze of the spectator.

2.3 Terminology

Across the range of relevant disciplines, there is variation in critical usage of several basic terms that are at the heart of my research. Specification at this initial stage, therefore, may be helpful.

- **Artefact** can, in its broadest sense, reference any manufactured article, though it is more commonly employed to refer to art-works, or objects of artisan use, in order to privilege their material and constructed, often hand-made, properties. I use the term on occasion as a synonym for **print**, for precisely this purpose and to minimise repetitious language.
- **Material** and **materialities**, in the context of this research, refer to the physical attributes of artwork that characterise its embodiment as object and are salient for sensate appreciation. Alternative and subsidiary meanings, where *material* refers to the constituent composition of an article, or indicates that something is *material* or pertinent to an issue, are evident at the point of use.

- I use the term *aesthetic* in its eighteenth century sense of ‘relating to perception by the senses’ (Oxford English Dictionary). As such, it is intended to carry no evaluative implication of ‘beauty’ or ‘sensual pleasure’. Descriptive of an artefact – for example, ‘the print’s *aesthetic* properties’ – it refers to the attributes of construction or design that are salient for viewers’ sense appreciation. Applied to the viewer – for instance, ‘her *aesthetic* response’ – it refers to subjective feelings or emotions, cognitions or evaluations experientially arising from engagement with the artefact as art-work.
- I use the noun *print* to refer to the realised and presented artefact in its form as a material object, achieved through one of the processes of mark-making entailing the reproduction or transfer of an *image of origination* that may be autographic, as with engraved or etched plates, or photo-mechanically, photo-chemically or electronically prepared, for example as a film negative, transparency or digital file. Whilst some modes of production permit of only one ‘print’ – mono-prints, for example, or Polaroid photographs – most reproduction processes are designed to allow the manufacture of multiple, possibly editioned, copies. I explicitly recognise that, within the materiality of the substrate, two-dimensional prints exhibit properties of ‘thickness’ or ‘relief’. In the context of this project, a print refers to a ‘visually appreciated articulation of authorial intention’. Of itself, a newspaper page or laser printed photocopy would not qualify unless that was the particular medium specifically determined by the artist for expressive purposes. A ‘*photographic print*’, accordingly, is a print where both the image of origination and the method of its production utilise photo-mechanical, photo-chemical or photo-electronic modes of production, whereas a ‘*photograph*’ invariable refers to the digital or analogue method of origination but provides no further information about its material

realisation. Conversely, the descriptions ‘platinum print’ or ‘carbon transfer print’, for example, reference their methods of production but are silent about the mode or subject of image origination.

- I take **image** as a generic term to describe any visualised scene, pattern, articulation or representation that may be held simply as an internal mental construct or realised in some physical form, for instance as a painting, drawing, photograph, diagram or road sign, or more fleetingly as a screen projection. Paul Crowther (2009: 26) describes the creation of a ‘*visual image*’ as the configuration of ‘material so as to represent some state of affairs other than the material itself, using isomorphism in terms of such things as shape, colour, texture, volume, and mass, as the major basis of reference’. The effect, though, of the qualification ‘visual’ in his definition is to demote the tactile, olfactory and aural to subordinate sensory contributions.
- The vernacular use of the term **picture** embraces also a wide range of applications and productions, though commonly – where it is not simply a synonym for ‘image’ – the reference is to some specific commercialised artefact of visual display, frequently representational or figurative, and I use it broadly in this sense to refer, as the contexts indicate, to two-dimensional art-works, prints, newspaper and magazine reproductions and to screen projections.
- My research considers the cognitive and affective lexicon of thought and response to a selection of early process prints expressed by volunteer audiences (Response Groups) as they report their ‘*thinking about*’ and ‘*feeling about*’ prints. A distinction is commonly made between the domains of **affect** and **cognition**, and this provides my starting point (Shouse, 2005). Photographs offer information – ‘visual content’ or ‘visual description’ articulated as image – that is available, and more or less

accessible, for cognitive appreciation and affective, experiential response. For current purposes, cognitive activity may best be considered as linguistic propositional description. For any *thinking about photography* to take place, the transposition of the visual to the literary, from sight to words, is unavoidable (Burgin, 1982). In that sense, the language of photography is language and, since language is the privileged cultural resource and hegemonic vehicle, there can be no cognitive appreciation of photographs that is unformed by social signification and its personal experiential mediation. There is, in English, a generosity of language of the affective domain. Emotion, mood, sentiment, temper, humour and feeling, for example, are all terms in popular use, generally synonymatically and interchangeably defined. Theorists however have attempted more specific demarcations and, taken broadly, 'affect' has been privileged either as the overarching concept accorded to all sensations of feeling and emotion or, more recently, theorised as autonomous non-social/pre-human 'experience of intensity' (Massumi, 1995). In the latter case, before its transliteration as internal personal '*feeling*' or social articulation as '*emotion*', affect is conceived as an organistic excitation and state of preparedness that is beyond or outside language (Shouse, 2005).

For the purposes of this research, however, I follow theorists of the 'affective turn' in the use of the term very broadly as a generic indication of sensate disposition to the stimulus of the cultural object (Clough & Halley, 2007). I assume that affective response may be inferred through verbal or behavioural expression, which is how I attempt to record it, indicative of subjective feelings and potentially of socially recognisable emotional states. Affective responses may be experienced outside of any lexicon, as for example can be the case with music. Nevertheless, I ask viewers to transpose their sensate responses (feelings) into language – words of their own

choice admittedly, but established cultural significations – as the only vehicle we share for exchange of information.

2.4 Research methods and procedures

The empirical data sought for this research project are threefold – print '*materiality*', '*performativity*' and '*mattering*' – requiring quantitative and qualitative procedures for collection and analysis:

- Empirical issues of *materiality* and *performativity* – the quantitative lexicon – are explored through the examination of the surface properties of contact-prints, produced under specified circumstances and techniques, in order to describe their material attributes and to assess the potential benefits of the employment of digital inkjet printed negatives. (2.4.1, below)
- The qualitative lexicon of viewers' cognitive and affective responses – that is, the enquiry into *mattering* or aesthetic response – is generated by data reported by Response Group respondents' handling and engagement with a selection of contact-prints. (2.4.2 below)

These data and their theoretical and instrumental analyses inform technical, material and performative aspects of the production of creative works, available on exhibition.

2.4.1 Material-syntax – the quantitative lexicon

This strand of the research firstly describes the material-syntax attributes of prints produced by selected early contact-printing processes and, secondly, explores the relationships between these print attributes and different types of inkjet negatives and ultraviolet light sources. Thirdly, in relation to the quantitative description of print properties, the hypothesis that varying permutations of UV source and negative colourisation have an effect on print properties is examined. The following sections outline the photographic printing processes and the attributes of the prints selected for these evaluations, and the rationale for the choice of substrate, inkjet printer and UV source.

Production of early process prints is affected by the operation of a large number of factors; in addition to the nature of the paper support or substrate and any pre-treatments, these include:

- type and nature of negative substrate – with digital inkjet negatives, the type of printer, printer driver and inks, and with film, its density, colour and grain structure
- spectra and intensity of ultraviolet exposure radiations
- coating of photosensitive chemistry – composition, quantity and evenness of application
- moisture content of coated paper before processing
- environmental humidity and temperature
- image development recipes and treatments
- post-process treatments, such as waxing or varnishing

In evaluation of print materialities, the research makes no attempt to quantify the effects of each of these individual process variables, but seeks to provide co-variation descriptions of a selected sub-sets of attributes of prints produced, as near as possible, under standardised conditions.

Contact-printing processes

The contact-printing photographic processes selected for examination are chosen to be broadly representative of amateur and commercial techniques and technologies in use in the latter half of the nineteenth century, but do not include those of mass-production printing. In common with many non-industrial production processes they allow opportunity for the exercise of handcraft and authorial skills in print production and form the basis of my personal practice. The contact-printing processes (described in Chapter Five and its Appendix) include:

- Platinum/palladium¹

¹ It is now common practice, on cost grounds, for '*platinum*' prints to be made with a mixture of platinum and palladium salts

- Salt and albumen
- Polymer-plate photogravure (as a proxy for copperplate gravure)²
- Cyanotype
- Carbon transfer
- Digital inkjet included for purposes of reference and comparison

Print attributes

There are no formal contemporary statements, either theoretically or industrially generated, that are broadly accepted as encapsulating the aesthetically salient material attributes of photographic prints. Conventionally, industrial assessments of quality are now made against standard *origination targets*. In other words, it is usually the case that fidelity of reproduction, not creative possibility, is the goal of production and the focus of industrial research. This concern with quality of reproducibility against a defined standard permits both the reliability and validity of operational parameters to be calculated objectively. I consider attributes that are expressive of specific process characteristics and craft manufacture, namely:

- resolution or sharpness
- maximum density (reflectance)
- range and differentiation of tonal scale
- glossiness and surface texture
- mottle and noise.

Industry descriptors more relevant to mass-production processes, such as gloss variation, colour gamut and shift, are omitted from the investigations.

Substrate attributes

The substrate, usually paper but also glass or plastic, strongly influences the achievable resolution and perceived sharpness of the print. Resolution and tone reproduction

² Polymer gravure plate provides a more convenient and, aesthetically, a broadly equivalent technique for the production of intaglio prints

characteristics are affected by the ways in which light scatters in the paper, in turn mediated by the pre- and post-production surface coatings of the print process (Inoue *et al.*, 2000). Properties of paper substrates contribute both to viewer appreciation and to the qualities of reproduction. Paper brightness, that is its *whiteness* and *reflectance*, is a factor of the base colour of the material and any added optical brighteners that fluoresce in the presence of sunlight or other UV sources. These attributes mediate print contrast and ‘impact’ as they affect viewers’ perceptions of tonal range and differentiation. The differences, potentially of aesthetic significance, between light reflection, absorption and scattering from the print process’ pigmentation and the reflection (or glossiness) of substrate coating, calendaring and texture, are evaluated by pre and post-production assessment.

There are many different types of commercially available art-papers that are currently used for nineteenth century contact-printing processes, each made with particular composition and treatment. Key paper variables that affect the final print are the constituent fibres, the internal and surface sizing, buffering, roller pressing or calendaring, and the paper thickness or weight. Cotton papers, 100% cotton rag, made from the longest cotton fibres, are generally considered the highest quality. Cellulose papers and cotton/cellulose combinations include wood pulp and are invariably ‘buffered’ with alkaline carbonates to render them ‘acid-free’ and less likely to discolour or deteriorate over time. Differential sizing and calendaring produces paper with variously smooth and hard (hot pressed or HP), smooth (cold pressed or NOT) and rough or textured surfaces. The absorption of photosensitive coatings is strongly affected by the papers’ surface properties, which affects print densities and reflectances and may also moderate the colour of the print, for example with salt and kallitype processes. A sample of ten papers was selected for initial testing (*Phase A*) and two taken forward for more extensive examination (*Phase B*).

In the light of the very wide variety of historical techniques that have been employed, and their frequently autographic application, no assessment of post-production processes of waxing, polishing, rolling or sizing with gelatine or starch was included within the research.

Inkjet printers, negative substrate and ultraviolet light sources

Because of time constraints, only one professional standard model of inkjet printer, an Epson 3800 with a 'K3 ultrachrome' inkset with black 'photo-ink', was used to prepare the inkjet negatives for the evaluation of prints. The printer was used to produce standardised inkjet transparencies on 'Agfa Copyjet' and 'Pictorico' acetates, which are commonly used as substrates. Fluorescent tubes, incandescent bulbs and light-emitting-diode (LED) ultraviolet sources, with different emissions spectra, were selected for the tests: a bank of eight 20 watt actinic ('black-light') fluorescent tubes (Sylvania F20W/350BL), a 1000 watt metal-halide bulb (Natgraph), and an array of 375nm surface mounted LED strips.

Detail of the protocols for the investigations and reports of the findings and analyses are set out in chapters Five and Six and supported in the Appendices to those chapters.

2.4.2 Material-syntax – the qualitative lexicon

The aim of this empirical strand of the research is to explore the affective and cognitive saliency that the materiality of prints may have for viewers through the collection and analysis of their vocabularies of description. A three-phase investigation was devised to record and analyse the lexicon used by lay-viewers to describe aspects of the appearance of a selection of images, each performed as prints using nineteenth century contact-printing processes:

- Platinum/palladium
- Salt and albumen
- Polymer-plate photogravure (as a proxy for copperplate gravure)

- Cyanotype
- Carbon transfer
- Digital inkjet included for purposes of reference and comparison

The chosen 'early' printing processes provided for a variety of print surface, texture and materiality, matching the processes used in the quantitative evaluations. Digital inkjet prints were also included as a comparative reference. The printing processes and techniques are described in Chapter Five and its Appendix. Significant in shaping viewer responses and narratives, of course, are their appreciations of the function of the print display. Images are rarely encountered in everyday life without clear environmental cues regarding the reasons for their presentation and the potential 'meanings' available for viewers to infer. Presumptions of purpose – be it, for example, for reasons of fine art expression or commercial marketing – shape the paradigms of interpretation available. In this investigation, attention was deliberately drawn to the nature and materiality of the prints. Participants were not discouraged from attending to the image content – indeed, several respondents commented on the appropriateness, or otherwise, of the nature of the process for the expression of the image – but it was clear that the investigator's interest lay in the print as artefact and not with the print as an art work or technical exercise or stimulus for market research.

The investigations were planned in three phases, as follows:

Phase 1:

Pilot study: Response Group viewing of *representational and non-representational* prints with recording of the words/terms used by members for description and evaluation of the prints and their responses. Respondents were able to handle all the prints and make intimate comparisons (reported in Chapter Seven).

Phase 2:

Main study: questionnaire recording of individual written descriptions of sets of representational *images*, each set composed of prints of the same image

made using selections from eight printing processes. Respondents were able to handle all the prints and make intimate comparisons. (The images are shown in Chapter Seven).

Phase 3:

Analysis of descriptive lexicons from phases 1 and 2 and preparation of semantic-differential scaling instrument (reported in Chapter Seven). A follow-up study using a semantic-differential scaling instrument completed by respondents viewing selection of prints mounted and gallery hung was not completed and was eventually abandoned due to difficulties in securing gallery space (reported in Chapter Seven).

Phase 1 – Qualitative lexicon

This phase of the research involved the initial Response Groups viewing figurative, representational image prints and secondary groups viewing non-figurative prints, each set produced by the selected photographic contact-printing and reference processes. The approach adopted was simply to ask respondents to record on series of 'Post-it' notes whatever words or ideas came to their minds when looking at different prints. The purpose of this pilot phase was to test whether this method gave data that might give an indication of the respondents' aesthetic, affective or cognitive reaction to the works. Respondents were prompted to address the 'feel', 'substance', 'nature', 'appropriateness' and 'appearance' of the print. They were not given any indication of the nature or title of the processes used to produce the prints, though in the case of cyanotypes it would have been fairly obvious.

Phase 2 – Qualitative lexicon

This phase of the research involved respondents, in small group and individual settings, viewing untitled figurative prints of anonymous process. The respondents provided written questionnaire descriptions of some or all prints, as they thought appropriate, from sets of

images, each set composed of prints of the same image produced using different contact-printing processes. Again, they were not given any indication of how the prints were made.

Phase 3 – Qualitative lexicon

The descriptors offered by the respondents in Phases 1 and 2 were examined using a variety of tabulations and correlations to relate the vocabularies to attributes of the prints, namely: their type of process, colour and surface texture, and to the empirical descriptions from the earlier quantitative assessments. It was not the purpose of the research, and it was also deemed inappropriate given the relatively modest number of participants in the enquiries, statistically to correlate respondents' vocabularies with specific print materialities, or to identify through cluster analysis any underlying affective categorising dimensions (Bushan *et al.*, 1997; Khan & Vogel, 2012; or Marchesotti *et al.*, 2011). However, it was possible to prepare a semantic-differential scaling instrument along continua, incorporating or accommodating the terms volunteered by the respondents, for planned employment in future research.

Detail of the protocols for the qualitative investigations and reports of the findings and analyses are set out in Chapter Seven and supported in the Appendix to that chapter.

Chapter Three

The syntax, language and representational status of photographs

'Thanks to the code of connotation the reading of the photograph is .. always historical; it depends on the reader's "knowledge" just as though it were a matter of a real language, intelligible only if one has learned the signs'.

Roland Barthes (1977: 28)

In this Chapter I consider whether there is what might be termed a *photographic syntax* or *language* and, if so, how its deployment is arranged and how its articulation may be mediated by the process and materiality of the print. I review aspects of theoretical investigations of the ontology and performance of photographs in order to secure a methodological context for my empirical investigations and to inform my personal practice. I am interested in the 'work' done by photographic prints for viewers, and in the cultural structurations that support shared understandings. Two issues here are of relevance for my practice. Firstly, there is continuing discourse between claims for the 'mind independence', 'automaticity' or 'transparency' of photographs (Currie, 1991; Scruton, 1981; Walton, 2008) and those that allow the space I seek for authorial 'agency', 'consciential' or 'intention' (Costello, 2012; Phillips, 2009; Van Lier, 2015). The second issue is whether there are specificities of language or syntax that underpin photographic communication and structure the affective resonance of the print through its materiality and realisation.

3.1 The transparency of the photograph

To start with the act of seeing, which by current accounts is not 'mind-independent', the human '*total vision system*' describes the reception, neural encoding and transmission of retinal images and their subsequent interpretation as representations of the external environment. Wandell (1995: 5), writes, 'we perceive object properties from the retinal image by inference, not deduction'. The retinal image information is ambiguous and incomplete, and usually the retinal image can be interpreted in many different ways. On

Wandell's physiological account, sensory perception cannot offer unmediated access to the external world; because we begin with ambiguous information, we cannot make deductions from the retinal image, only inferences. Yet, in the continuing debate amongst photography theorists and philosophers about the status of the photograph as a representation of reality, it is for just this alleged facility that photography, and our perception of its images, has been both celebrated and critiqued.

Non-abstract pictures, including prints and photographs, are rarely treated as entirely self-referential. They are commonly and intuitively held to be images *of* something, that is they refer to or represent objects or ideas external to the picture itself (Clarke, 1997). All two-dimensional visual representation of externalities requires transpositional codification, itself an expression of shared cultural convention. There are no degrees of likeness or depiction that can be assessed, as it were, independent of the ideological, perceptual and social resources of the analyst (Elkins, 2003).

Ernst Gombrich (1960) argues that the retina's visual impression requires prior mental conceptual understandings of the world, referred to as *schema*, in order to allow of the production and consequential perception and interpretation of stimuli as images. Pictures, he claims, stimulate the identification or interpretation of depiction through their viewers' collaboration in the maintenance of visual illusion, not simply acceptance of a representational reference. Richard Wollheim (1980) is uncomfortable with Gombrich's notion of illusion as the basis for depiction, he conceptualised the recognition of pictorial depiction as a *twofoldness* experience. By that he means viewers are simultaneously aware both of the surface of the painted surface and of *seeing-in* past the surface.

For seeing-in to occur, two things are required: 'I am visually aware of the surface that I look at, and I discern something standing out in front of, or (in certain cases) receding behind,

something else' (Wollheim, quoted in van Gerwen, 2001: 220). In other words, there are two simultaneously combined experiences involved in the perception of pictures: *configurational* awareness, the apprehension of the picture surface, and the *recognitional* grasp of something in and beyond that differentiated surface – the *seeing-in* of the depiction.

Kendall Walton (1992: 283) expands the twofoldness of pictorial depiction to embrace the spectator's constructions that he posits as 'make-believe'. Walton's recognitional aspect describes the viewer's imagination of the picture as an imagination of something else – not an imagining that the picture itself is something else, as with *trompe l'œil* – more accurately, a *perceiving-in* rather than *seeing-in* (Walton, 1992: 285). In this account too, the picture surface is accorded aesthetic saliency, though its actual materialities are unexplored.

Walton, locates in its '*transparency*' the inability of the photograph to be representative. The viewer looks through the photography directly to the object, the viewer's relationship is with the object not the photograph. This is a conceptualisation endorsed by Scruton (1981), he asserts that the photograph carries no aesthetic interest.

'The photograph is recognized at once for what it is - not as an interpretation of reality but as a presentation of how something looked... The photograph is transparent to its subject, and if it holds our interest it does so because it acts as a surrogate for the represented thing' (Scruton, 1981: 598).

Scruton is very clear, art works represent an object by expressing thoughts about it, which the photograph and the photographic print cannot do. This is the fundamental matter of whether the image articulates, in Abigail Solomon-Godeau's phrase, 'the author's interior or the world's exterior' (Solomon-Godeau, 1984: 151). It is Scruton's assertion that the automaticity, the mechanical causality, of the photographic process prevents the articulation of authorial conception and intention: 'photographic depiction is independent of the intentions of the photographer in the generation of the image' (Scruton, 1981: 584).

Dawn Phillips does not claim aesthetic status for the photograph by privileging the authorial control exercised by the photographer's choice of viewpoint, lighting, composition and so forth. Instead, she draws attention to the compound duality of photographic enterprise. Photography, she states, involves both an initial photographic event, the making of the image, and its consequent re-production - a visual material object in its own right.

'We appreciate the photograph in virtue of appreciating its relation to the photographic event, but the photographic event should not be conflated with the photograph... My view is that we should understand photographs as analogous to performances of music rather than to paintings or literature.'
(Phillips, 2008).

Phillips, here, is building upon Ansel Adams' earlier detailed descriptions of his *performance* of prints from the treatment of the '*musical scores*' of his negatives (Adams, 1983: 2). Adams' work represents an apotheosis in the achievement of the ineffable '*fine print*' – a guiding star for generations of Camera Club pilgrims. His articulation of the role of his pre-visualisation of the final photographic image – shaping the composition and treatment of the negative and its manipulated incarnation as a positive print, structured through his *Zone System* description of tonal values – rebuts any argument of the automaticity of production. This approach, exemplified also by his '*f/64 Group*' colleagues, celebrates the interpretative aspect of the photographic composition or script (Alinder, 2016).

Although Phillips does not use the term 'print' in this specific context, I value the authorial space offered to the printing processes by this notion of the *performance* of photographic images. These approaches – both Adams and Phillips – celebrate the interpretative aspect of the photographic composition or script. Separation of the event of photographic origination from the, later, print production accords with vernacular experience of photographic practice. It allows for intentional authorial contribution both to the photographic event and to its consequential articulation as image. Thus the print artefact is a realisation, an enactment of photographic representation, a performance that next time

may be choreographed differently. This enactment is the focus both of my investigations of the properties of different print processes and of the lexicon generated by viewers of the prints.

3.2 Pictorial language

Susanne Langer holds that pictures have neither a vocabulary of units, analogous to words with independent meanings, nor any stipulations for the sequencing or temporal arrangement of lines, shapes, colours or other authorial marks.

‘A symbolism with so many elements, such myriad relationships cannot be broken up into basic units. It is impossible to find the smallest independent symbol, and recognise its identity when the same unit is met in other contexts... There is, of course, a technique of picturing objects, but laws governing this techniques cannot properly be called a ‘syntax’, since there are not items that might be called, metaphorically, the ‘words’ of portraiture’ (Langer, 1951: 88).

In this account, the pictorial and, hence, the communicative import of artists’ marks and shapes can be construed only in the context of the signification of the image as a complete entity. Once the whole is identified, meaning is redistributed back to the parts. For Langer, pictures, along with music and other expressive arts, are distinguished as *presentationally symbolic* in contrast to the *discursive symbolism* of language. In her view, it is a fundamental property or imperative of the human mind to seek and to impose meaning on the world, narrating experience. The discursive symbolism of the language of words provides a rule-based, context-invariant and shared articulation of explicated meaning. In contrast, the presentational symbolism of the arts is effective through the apprehension, or rather construction, of the meaning of the whole, not the sequenced sum of the parts. She holds that presentational symbolism provides for highly nuanced, shaded and emotionally coloured communication, what she describes as the ‘forms of feelings’ that are known and understood but cannot necessarily be translated into, as it were, ‘*the frozen formality of non-poetic words*’ (Langer, 1979: 397). ‘The real power of music lies in the fact that it can be

“true” to the life of feeling in a way that language cannot; its significant forms have that ambivalence of content which words cannot have’ (Langer, 1979: 206). Within this account, pictures – including photographs – do not demonstrate the repertoires of rule-based combination that is one of the fundamentals of language structure.

In contrast, in his earlier works, Umberto Eco maintained that pictures demonstrate a functional equivalence to linguistic signs (Eco, 1978: 233). Every representational pictorial image is a rendering of a three-dimensional world in a two dimensional medium. A pre-requisite, therefore, is some form of shared system of signification to encode the relationships between elements in the pictorial world in order to communicate these to the viewer.

3.3 Visual semiotics

Compared with the more socially focused ‘communication studies’, there appears to have been relatively few empirically based semiotics investigations into what it is that people actually do to produce and respond to visual significations. The focus for semioticians has been upon the theoretical development of structural and post-structuralist models of signs systems. Two fundamental questions posed by semioticians are relevant to my examinations of the print artefact. How do pictures, in particular photographic prints, operate materially as signs and how are their functions structured within coded sign systems?

Charles Peirce described portraits, and paintings in general, as having an iconicistic relationship with the object. In contrast, he held that photographs, by virtue of their production ‘under such circumstances that they were physically forced to correspond point by point to nature’ (Pierce, 1958: 281) are in indexical relationship with the objects they depict, *traces* left by referents. In Roland Barthes’ early view, the photograph must privilege the indexical denotation of its subject, at the expense of connotation, and the photograph

may be taken as an objective representation of reality: its *'capture without agency'* the corner stone of (the myth of) photographic objectivity. In terms of the production of the print in magazine, advertising hoarding or newspaper, however, he describes connotative codes as articulated within the media and styles of presentation and, as such, are received, perceived and related to a 'rhetoric' by a public 'that consumes it to a traditional stock of signs' (Barthes, 1977: 19). I find this distinction and prioritisation helpful and I treat the mode and medium of the physicality of the photographic print's presentation in precisely this sense, as rich in connotative potential – not dissimilar to Clifford Geertz's endorsement of *'thick description'*, sensitive to cultural signification and relationship in the management and treatment of material objects (Geertz, 1973).

There remains an issue of whether the photographic image, as an optical/mechanical/chemical construction, is both coded and also code-presenting. The proposition that visual information, both articulating cultural connotations and incorporated within them, is itself without code remains a contested matter, though it is difficult to conceive of a sign, whether material or not, as unmediated in some way by its carrier medium. As Hodge and Tripp note, 'fundamental to all semiotic analysis is the fact that any system of signs is carried by a material medium which has its own principles of structure' (Hodge & Tripp, 1987: 17). Eco (1978: 267) also is clear that media are not neutral, each medium is 'charged with cultural signification', each has its own *'affordances'* and *'constraints'*.

3.4 The syntax of the print – materiality and signification

William Ivins (1953) explores precisely that affordance and constraint. He identifies, for each print technology save the photographic, a distinctive *syntax* of design and execution. The pictorial output of each process is marked by, indeed achieved through, a particular structure of mark-making and image transfer with its own 'grammar' and rules of execution. At the

level of the self-evident, for example, wood-cuts printed as reliefs are unable to carry the fineness and detail of line exhibited by intaglio printed engravings or etchings.

The differences between Ivins' notion of '*syntax*' and conventional descriptors of 'style' and 'school' are not always clear. In places it is evident that by '*syntax*' he refers to the exigencies inherent within the techniques and technologies of the print making process – that is, the productive constraints of technology and material. Elsewhere, he uses '*syntax*' to describe authorial modes of design, transposition, incision and the articulation by line and shading of form, volume and recession. In these cases, it appears Ivins' concern lies with authorial syntax, or rather artistic 'styles', that are, at least in some significant regard, independent of the medium of production. That his prime interest lies with the structure of the processes, though, is evident in his account of the introduction of photographic and photo-mechanical technologies. Photographs, he holds, are totally without syntax – prints produced through photographic process are achieved without the expressive contribution of human hand and eye, save to operate machinery automatic in process and result. Such a direct copy of the world, sans syntax, compares dramatically with the multiple transpositions and interventions required for the preparation and pressing of etchings and engravings.

In her examination of graphic arts, Estelle Jussim (1983: 12) evaluates Ivins' theories in the light of emerging theories of visual communications. She distinguishes clearly between the *channel* and the *code* of communication - the channel being, in effect, the materiality of the image that is the observable articulation of the structured elements of visual information, coded according to the available conventions of transposition. Taken together, the channel and code are both the medium and its message.

'Pre-photographic, or non-photographic, messages relied upon a packager of information, called an illustrator, to codify what his own idiosyncrasies recorded of three dimensional reality, using artistic media in a way largely dictated by the artistic conventions of his day. The artist's drawing or painting was then given into the hands of an engraver, who also operated with graphic codes dictated by

the graphic conventions of the day and subject to sometimes stern technological restrictions. The final printed messages were performed at least three times removed from reality, and must be viewed as symbolic representations of ideas which we interpret' (Jussim, 1983: 73).

A first generation photographic negative might be argued to be the result of an optical/mechanical/chemical automaticity of coding. The second generation printing plate and third generation printed artefact are the product of transpositional coding choices – a syntax free photographic message on that account is inconceivable.

William Crawford (1973) also was unable to accept the denial of syntax to photography.

Ivins thought that photography and the photomechanical processes had no syntax. This is a conclusion some photographic historians find hard to accept, because the differences among photographic and photomechanical prints are actually as great as the differences among the various sorts of prints made before photography began' (Crawford, 1973: 5).

Crawford argues that the technologies of the photographic process determine the envelope of creative and representational possibilities for the photographic author. For Crawford, photographic syntax is shorthand for the combination of the capabilities and characteristics – both technical and material – of the lens, shutter, film and process.

'The camera syntax consists of the technical elements that set the limits on what can be recorded on the sensitive surface of a film or plate.. Once the exposure is made, the latent or negative image must be transformed into a positive one. The syntactical elements that determine how the image finally appears can be called printmaking syntax' (Crawford, 1973: 13).

Clearly, at any point during print production, process attributes such as lens acutance, signal noise, tonality range and depth of field have finite technological potential within which photographers must operate. These syntactical possibilities, to continue Crawford's terminology, vary markedly according to choice of camera equipment and recording and printing materials. Use, however, of the term 'syntax' simply to draw attention to the parameters of technological determinism risks losing Ivins' insight into the cultural

conventionality of modes of artistic transposition; conventions evident in the common and continuing practice 'to improve' by various manipulations the look and details of a print.

The contribution of the viewer does not appear to have been a matter of particular concern to Ivins. 'While there is very definitely a syntax in the making of visual images, once they are put together there is no syntax for the reading of their meaning' (Ivins, 1953: 64). He bases this assertion on his understanding, shared by Scruton, that pictures are not 'read' in any sense sequentially, viewers may and do start their visual scrutiny at any place in the picture and move onwards and around in any direction and frequency, with the same final result. This is a literal and restricted use of the term 'reading' that does not expose anything of the processes of apprehension and decoding necessary to complete communication of visual 'texts'. As Jussim (1983: 73) sets out, all visual messages are, by their nature, coded communications and their reception is conditional upon active interpretative participation by the viewer 'reconstructing' both informational and affective potential.

In the context of this research, my interest lies in the mediation effected by attributes of the print artefact to its construction and reception. On the one hand, the technology and material properties of the processes mark the boundaries of the modes and possibilities of authorial expression and authenticity; on the other, the codes and inscriptions required for cultural exchange effect moderation of the reception and construction of visual meaning. Kress and Van Leeuwen (2006) have written on what they refer to as the 'grammar of visual design'. They examine the culturally contextualised and structured regularities, or 'grammars', of picture composition and construction. 'Despite the very large amount of work done on images, not much attention has been paid to the meanings of regularities in the way image elements are used – in short, to their grammar – at least not in explicit or systematic ways' (Kress & Van Leeuwen, 2006: 5). For Kress and Van Leeuwen, social interaction in the production and reception of communications is the key to understanding the grammars and

meanings of pictures. This is what makes their cultural/visual studies approach distinct from earlier semiotic theories. They view the grammars of imagery as organic, culturally specific resources that are shared both within and between social groupings but are developed by the actions of individual sign-makers and producers.

‘Where de Saussure had said that the relation of signifier and signified in the sign is arbitrary and conventional, we would say that the relation is always motivated and conventional. Where he had seemingly placed semiotic weight and power with the social, we wish to assert the effects of the transformative role of individual agents, yet also the constant presence of the social: in the historical shaping of the resources, in the individual agent’s social history, in the recognition of present conventions, in the effect of the environment in which representation and communication happen’ (Kress & Van Leeuwen, 2006: 12).

The analyses of Kress and Leeuwen conceive a motivated visual communication that accommodates the meta-functions, mode and material of production.

Their approach is notable for its very detailed and comprehensive descriptions of visual production, socially and culturally contextualised, as the purposeful manipulation of the mode, material and structuration of resource. ‘The material expression of signs, and therefore of the text, is always significant; it is what constitutes ‘signifier material’ at one level, and it is therefore a crucial semiotic feature’ (Kress & Van Leeuwen, 2006: 217). Systems of meaning, culture specific, are encoded in the materials and technological modes of production.

3.5 Material matters

The shifts from meaning alone to mattering and from content to social process are integral to material approaches to photographs and have demanded an analytical approach that acknowledges the plurality of modes of experience of the photograph as tactile, sensory things that exist in time and space and are constituted by and through social relations' (Edwards, 2012: 228).

The social history of cultural objects has over the last decade been a subject of significant interest. Field researchers and theorists alike have paid particular attention to the 'work' done by photographs. Elizabeth Edwards expresses the question thus: 'why do photographs as "things" matter for people?' (2012: 224). This extension of analysis, from the indexicality and transparency of photographs to their agency as cultural objects that matter and are meaningful, locates the photograph as a resource within networks of social practice and political and economic relations. It privileges subjective and affective investment in artefacts, ameliorating reductionist tendency to define images in terms of their visual apprehension alone.

Kress & Van Leeuwen (2006: 215) explicitly recognise that the materials of communication exploit a range of what they refer to as 'signifying resources'. Some cultural and historical signifying systems, they note, are common across many media, whilst others are tied to a specific medium or mode of production as unsemioticised material is drawn into semiosis. Hand-made photographic works, by planographic or intaglio printing process, for example, have signifying resources available for authors in two, even three, dimensions that are denied to reproductions on screen, or in a book or magazine that utilise other resources. The issue is raised of the congruence between the characteristics of the material and the completeness of mimetic persuasion of the product (Kress & van Leeuwen, 2006: 224). Any fissure allows the immateriality of the artefact to become material; the canvas showing through the painting, for example, or the 'grain' in a photograph, becoming in their turn available as a resource for or of signification, with or without authorial direction and intention – a material

no less than a visual *punctum* (Barthes, 2002). It is precisely the physicality of this interruption that Edwards wishes to foreground, to recover for the object something of the semiotic privilege accorded to the representational.

‘Throughout the history of photography the visual properties of the surface of the image have depended on the material. They have exceeded the direct indexical visual use, and created, literally and metaphorically, another dimension to the image.. Material forms create very different embodied experiences of images and very different affective tones’ (Edwards, 2002: 68).

Such sensual engagement with the artefact has been explored using ‘*haptic*’ and ‘*optic*’ visuality as a metaphor for signification through materiality (Marks, 2000; and Peterson, 2007). In contrast with ‘*optic*’ or smooth vision, ‘*haptic*’ or ‘*striated*’ vision is conceived as more tactile – as if touching and feeling with the eyes, recognising the possibility of a visual embrace of the object. Originally developed by Marks for the theorisation of film, the concepts have been adopted more widely, and used loosely as an analogue for the saliency of the materiality of the object or to distinguish between the close viewing of detail and the more distant optical comprehension of the totality of the work. For example, the *haptic* close-up of pointillist painting technique contrasts with the *optic* naturalistic impression of the totality of the picture.

According to Thomas Mitchell (1994, 2005), this ‘material turn’ to the photography object and away from the photographic image is occasioned by the digitalised ‘*post-photographic era*’ that marks the disruption of the indexical relationship between image and referent. This line of enquiry acknowledges earlier modernist and now resurgent interest in ‘*truth to materials*’. ‘The nostalgic yearning for the hand-crafted unique object in whose surface the trace of the craftsman’s touch is indelibly etched is symptomatic of industrialisation and mass production, offering a mythical recuperation of the object of consumption’ (Riches *et al.*, 2012). Janis Jefferies (2013: 2) notes that there is ‘much more in the world than representations, signifying structures and ideologies – that non-human things exist,

independently of us, and that for us to understand matter and embodiment, we need to see it as active, dynamic and stemming from the primacy of relations’.

‘*New materialism*’, as this approach may be described (Connolly, 2013), aims to return to material the voice and agency allegedly denied by ‘social constructionist’ discourse that views all social processes and experiences as culturally and ideologically constructed. Barrett and Bolt (2012: 3) articulate this position emphatically. ‘In the 1980s and 1990s the influence of cultural theory spread beyond the boundaries of social and political theories and came to infect the arts and leach matter out of art’. They claim that theoretical conceptions of artistic activity reduced art to the mere produce of social hegemony and discourse that prescribe the very conception and articulation of creativity. ‘Through the colonization of the arts by cultural theory, art’s very materiality has disappeared into the textual, the linguistic and the discursive’ (Barrett & Bolt, 2012: 4). This celebration of the potential agentic authority and performative contribution of artistic material offers a dramatic paradigmatic shift; the aesthetic lies not as an output, for instance, of ‘discursive formation’ (Foucault, 1972), but as a dynamic *relationship* between human and material. In brief, the argument is that this symbiotic relationship is organised around embodied experiential ‘sensation’ that is some sense is culturally autonomous (Kristeva, 1980). The implications here, of theoretical relevance to my research, are twofold – the material of art matters as a medium of relational engagement for both artist and audience, and such engagement may not be reduced merely to textual description of cultural inscription, sensately it is before and beyond language.

This is reinforced in the ‘*affective turn*’, summarised by Eric Shouse (2005) – the power of communications media lies ‘not so much in their ideological effects, but in their ability to create affective resonances independent of culture or meaning’. Below the orbit of conscious thought, non-signifying *affect* is stimulated independently of intention or meaning, motivating the personal experience of subjective *feeling* and consequential cognition, action

or social display of *emotion*. Ruth Leys (2011: 347) describes this approach as a ‘widespread reaction against what has come to be seen as the straitjacket imposed by the poststructuralist emphasis on language and psychoanalysis, a reaction also motivated by the view that the body in its lived-in materiality has been neglected’.

3.6 Experiential performance – affect and feeling

‘..feeling was an epistemological problem for the late twentieth century criticism that saw the photograph as fundamentally a “material product of a material apparatus” whose history can be understood only in reference to the specific institutional frameworks in which the images is produced and circulated’ Brown & Phu (eds) (2014: 2).

There is a contemporary parallel interest in writing about photographic affect. Elspeth Brown and Thy Phu (2014) referenced both Victor Burgin’s *Thinking Photography* (1982) and the political materialism of John Tagg (2009) as approaches to analysis that resisted subjective autonomy and the saliency of affective resonance. *‘Feeling* became the collateral damage in the disciplinary war against the often depoliticised incorporation of photographic images into the art historical and museological cannon’, as Brown & Phu (2014: 2) describe the theoretical engagement.

At the heart of phenomenological research are first person reports of life experiences, elicited and appreciated free (*epochè*) of the prior presumptions, preconceptions and prejudices of the recording analyst. The phenomenological aspiration is to understand objects in the world – that is, to provide a rich or thick description. Jonathon Friday (2005: 340) writes, ‘photographs present themselves to consciousness, and [thus] reveal their nature by careful description of what they are for us in experience’.

It is a claim of some theorists of phenomenology that treatments which privilege the economic and cultural forces shaping production and consumption, or the historical contexts of stylistic development, overlook perhaps the single most important aspect of artworks,

namely how they are experienced and produced as consciousness of the world by the embodied subject. Paul Crowther (2009: 1) describes as *reductionist* those approaches that 'tend to assimilate meaning in the visual arts to the socio-historical context in which the works were produced or to models derived from literary analysis' and thus neglect the distinctively visual dimension. It is as if the sheer aesthetic power and experiential impact of art, what Crowther refers to as the *intrinsic significance of the image*, is set aside in the search for the circumscribing environment of its conception and consumption.

The point is, then, that the strategies of reductionist art history.. involves an almost exclusive concern with the image's relation to modes of consumption. Its aesthetically formed basis - its created status in the fullest artistic sense - is reduced to a mode of signification which counts as just one element amongst others in the 'construction' of meaning' (Crowther, 2009: 14).

A counter-claim would be that phenomenological descriptions, and many psychological accounts also, are *ahistorical* to the extent that they overlook either the conventional inscription of meaning and value or the cultural contexts within which responses to imagery are fashioned and are effective. Nevertheless, in respect of this research project, conceptual and methodological tools are required equally to interrogate the generative capacities and energies of the print artefact and to situate it, alongside its maker and audience, both culturally and historically.

3.7 Overview and preface to the investigations

Lens-based photographic 'images of origination' (whether film negatives or digital files) are testamentary documents. Through their response to reflected radiations, they attest to the presence of objects in the world independently of our subjective apprehension. Were the arrangements of the objects to be changed, or the lighting to which they were subject, their photographic trace inevitably would be different. In that sense, photography is mind-independent, its optical-mechanical-chemical-electronic automaticity circumscribing,

though by no means eliminating, the space for authorial invention and creativity – providing depiction, not representation, and denotation, not connotation. I find, however, that this is a limitation only on photography’s performance of origination, not upon the cognitive and affective re-articulation of its products. Authorial modulation of the recording of ‘*what-is-here*’ and, perhaps more importantly, of its subsequent performance as print or other image, is rich in experiential potential for maker and viewer alike. There can be no *straight photography*, merely works that camouflage – to a greater or lesser degree – the hand of the photographer and the coded conventions of projection and perception. Whatever the authenticity of the indexical relationship, meaning and mattering are formed outside the original photographic event. The material realisation of the photographic print is culturally coded and encoding, and, as significantly, potentially of creative saliency. It is this potentiality that is explored in Chapter Four which considers theoretical treatments of the body and skin, contextualising my practitioner statement, and in the further chapters presenting digital adaptations to the printing process (Chapter Six), and vernacular descriptions and responses to the materiality of prints (Chapter Seven).

Chapter Four

An inquiry into the corporeal – skin, body and persona

The previous chapter considered aspects of the syntax and meaning of photography. To inform the development of my professional practice, in this Chapter and its Appendix, I examine discourse on the representations of the skin, the body and the persona, and conclude with a practitioner's statement in relation to the production of works for exhibition. I make prints to examine and statement the physicality of mainly older subjects and the skin, surfaces, forms and textures of their bodies. In this context, I explore the potential for the print to articulate the integument and the corporeal. Meanings and values, culturally inscribed on the skin, fabric and form of the body, shape our relationship with individual identity and inflect our responses to the materialities of depiction. This chapter links art and photography theory (Chapter Three) with the production of prints (Chapters Five and Six and the Exhibition of works) and the lexicon and aesthetic impressions of viewers (Chapter Seven).

A key aim of this practice-based research is the exploration of material expression, what might be referred to as the 'skin' of the print, and its contribution - physical, haptic and cultural - to the depiction of the corporeal subject. Stretching the analogy, the print skin is clearly flayed. It is preserved, without interior or form save the material envelope on and in which it is suspended, a veneer bearing the chemistry of embalming. This thin skin holds the work, it forms the interface of the artefact with the world, and its qualities are the image's articulation and realisation. Each type of printing process makes and marks this skin distinctively – *Illustration 4.1*, below, shows examples of the surface of different processes from late nineteenth and early twentieth century and contemporary inkjet. Relief and intaglio printing processes may produce contours and slightly raised areas n the final print, giving a subtle



Photogavure



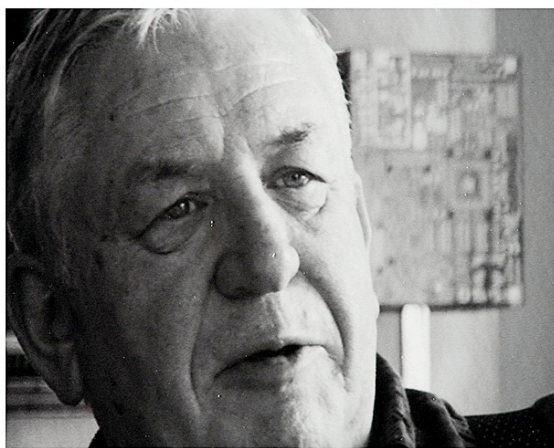
Carbon-transfer



Albumen



Cyanotype



Inkjet



Platinum

Illustration 4.1 Surface detail various processes – raked light. Photographs courtesy of Image Permanence Institute, Rochester Institute of Technology, used with permission.

three-dimensional impression depending on the nature of the substrate. Planographic photographic printings, again influenced by the texture and absorbency of the substrate, generally result in a more uniform, less textured surface. Authorial control of image detail, density and contrast is available for each process through treatments to heighten the reflectivity, or glossiness, and tonal range of the final image by the use of special inks or chemistry, papers, additional coatings and, now, digital interventions. It is a presumption of this research that the haptic of the printed artwork – articulated as the surface skin – informs and mediates cognitive and affective response to the image. As a prelude to subsequent chapters' considerations of different print processes and their material qualities, the following sections situate the 'skin of the print' within discourse on the meaning and symbolic value of the body and its surface. The Appendix to this Chapter considers changing conceptualisations of portraiture and offers a broader context for the development of my works.

4.1 The somatic turn

The emergence in recent years of postmodern and feminist thinking demands a reappraisal of how the body is represented in the visual arts. No longer a simple object of visual delight and innocent erotic delectation, the body is now understood to be the site of a highly charged debate.

John Pultz (1995: 7)

Social conceptualisations and valuations of the body are as fundamental in shaping the making and reading of portraiture as the subject's accoutrements and environs. The body has now become a focus of particular interest not primarily for its biological or anatomical character, but because it is now seen as the juncture at which the imperatives of cultural inscription and socialisation are effected. For some, queer theorists for instance, the body is the site at which individual and group response can articulate resistance (Adam, 2000). Visceral sensation may exist in raw immediacy, but there can be no understanding, literally no comprehension, that is independent of the language, symbols and social constructs that form the universes of our lives. Judith Butler (1990: 8) comments, 'there is no recourse to a body that has not always

already been interpreted by cultural meanings'. Inescapably, all imagery speaks of and from the culture and social experience of its creation.

4.1.1 Distinctive and docile bodies

Pierre Bourdieu's sociological account examines the *social capital* invested or carried by the body, particularly the *distinctive body*, distinguished by ability, appearance, posture, and attitude. 'The body is in the social world, but the social world is also in the body' (Bourdieu, 1990: 190). He conceptualises the body as an articulation of cultural capital, a demonstration and source of symbolic value and social inequality. As described by Schilling, he is particularly concerned with its contemporary commodification as a form of *physical capital* providing differential access to other resources of power and status. Commenting on Bourdieu, Schilling writes,

'Different classes and class fractions tend to develop distinct orientations to their bodies which result in the creation of various bodily forms. In the conditions of modernity, the symbolic values attached to these forms become particularly important to many people's sense of self' (Schilling, 2003: 112).

The form and cultural value of the body is the outward expression of a developmental process, realised through work, labour and life within a class location and social *habitus*, and through individual tastes for consumption and decoration (Brubaker, 1985: 758). As Bourdieu (1984: 190) notes, the way people treat their bodies 'reveals the deepest dispositions of the habitus...and engages the most fundamental principles of construction and evaluation of the social world'. Class, habitus and social field placement produce differential body formation, differentially culturally evaluated and differentially socially enabled. The aged body is no exception, physical capacity and physical capital decline and, for some groups, economic resource also. Schilling (2003: 122) states, 'central to the value of different forms of physical capital at anyone time, though, is the ability of dominant groupings to define their bodies and lifestyle as superior, worthy of reward, and as, metaphorically and literally, the embodiment of class'.

Bourdieu has been criticised for failing to consider fully the processes through which behaviours and values are ascribed to, and maintained upon, the marginalised or stigmatised - the black, gendered, or homosexual body for example. Michel Foucault's writings, in contrast, have been utilised extensively by feminist and queer theorists, amongst others, to inform analyses of the formation of the body – the docile body - by means of language and discourse (Foucault, 1991). The body is the delineated site of regimes of discourse and power. In Schilling's commentary, 'for Foucault the body is not only given meaning by discourse, but is wholly constituted by discourse. In effect, the body vanishes as a biological entity and becomes instead a socially constructed product which is infinitely malleable and highly unstable' (Schilling, 2003: 65).

Power is processual and diffused, though differentially negotiated and renegotiated throughout the practice, discourse and symbol systems of social relations. Whether within families, organisations, professions, religions, or the state, the paradigmatic determination of the language and symbols of 'truth' and 'knowledge' serves the inscription and construction of identity at the most fundamental level. For example, Lois McNay (1991: 130) writes, 'gender is not to be conceived merely as the cultural inscription of meaning on a pre-given sex, but rather gender must also designate the apparatus of production whereby the sexes are themselves established', the body is absorbed to the determining power of discourse. Not dissimilar arguments apply to the social constructions of old age (de Beauvoir, 1970), where parallels have been drawn with feminist analyses of the relationships between the biology of sex and the performance of gender (Featherstone et al., 1991).

4.2 Skin

'I know two sorts of painters: those who believe and those who don't believe in the skin'
Andre Breton (quoted in Woodall, 1997: 7).

Skin, as the boundary of cultural constructions of our physical entity, informs representation and interpretation of the body, ascribing and signifying – among other attributes – identity, ethnicity, age, status, health, gender and power. Historically, changing philosophical and medical conceptions of the nature and purpose of skin can be mapped against notions of selfhood and societal function, and are evident in artistic representation, particularly portraiture. Claudia Benthien (2002: 12), for example, does not accept that body perception, skin and the sense of touch should be 'considered to be a purely physiological matter, outside the realm of history.. human skin is not always present in the same way.. it, too, is subject to cultural notions that make it appear in a constantly shifting light'.

In early Western civilizations, the skin seems to have been envisaged as a body covering expressive of health and status. 'Despite wide acquaintance with the wounded and dismembered body in experience and representation, classical Greece seems...to have maintained a strong conception of the inviolability of the body, as guaranteed by the smooth and immaculate skin' (Connor 2004: 12). This smoothness and uniformity of boundary is certainly apparent on much sculptural representation and on later Roman copies. Aristotle's account, though, provides an interesting contrast, skin is formed '*by the drying of the flesh, like the scum upon boiled substances; it is so formed not only because it is on the outside, but also because what is glutinous, being unable to evaporate, remains on the surface*' (Aristotle, 1976 Vol. V II.6.743b).

Humoral theories of the body, their origins predating classical Greek and Roman times, were for over two thousand years the predominant therapeutic and philosophical framework within which the functioning of the body and its skin were understood (Connor, 2004: 16). Accounts

of the history of skin generally locate the start of modern European conceptualisations as recently as the late eighteenth and early nineteenth century with the emergence of clinical-anatomical paradigms (Fend, 2005: 312). Prior to this period, skin was conceived primarily as a porous sack, with its openings allowing for the exchange of humoral fluids. Barbara Duden (1991: 123) notes that 'the skin was fragile and it was a boundary, but it was not meant to demarcate the body against the outside world'. The skin did not isolate, but rather provided for continuous interchange of substance between the body and its environment.

The displacement of the humoral accounts allowed for the emergence of separated, individuated corporeality – 'the inhabited bourgeois body' (Bakhtin, 1984: 23). In European and Western society before the late eighteenth and early nineteenth century, the employment of cosmetics to coat and conceal with wigs, colourants and pastes, and the deployment of artificial beauty spots and high rouge markings was understandable in the face of pocked *actualité*. Skin tones were key descriptors in much of the literature and art of that and later periods. Beauty was translucent, female emotion evident through excessive pallor or reddening, blue pulsing veins as gendered sensibility. Masculine vigour showed as stronger colour, weathered perhaps, certainly deeper tones. A challenge for portraiture and artistic representation was the articulation, through the depiction of the skin and the contours and boundaries of the body, of both the mutability and power of emotion and also the perseverance of character, status and position – the inner and outer person jointly and severally depicted. Neo-classical practice, by David and Ingres for example, was to render the skin as smooth, barely present, without intrusive texture or feature. Subtle and accented use of (almost exclusively Caucasian) colouration, notably the face and hands, revealed the emotion and traits of the physical and psychic interior temperature; a commercial practice and ambition sustained through much of the nineteenth and into the twentieth century, despite the parallel universes of impressionism, fauvism and cubism.

In extreme contrast, over the last fifty years skin has been fore-grounded as the site of artistic exploration and performance, notably by women – for example, Orlan’s documentation of her cosmetic surgery in pursuit of beauty, Valie Export’s tattooed garter belt, Diamela Eltit’s cutting of her skin and Marina Abramovic in her 1975 performance of *Lips of Thomas*. Benthien writes, ‘In contemporary art, the surface of the body is defined as a projection surface and a fetish, a place of wounds and stigmatization, an individual dress or a cover to be modified. The display of female skin, in particular, often involves violence or self-inflicted wounds, cuts, and burns’ (2002: 3). The skin offers both a metonym for person, spirit or life, *pars pro toto* for the whole being, whilst simultaneously performing as a metaphor for the encapsulation and imprisonment of the self.

4.3 Old skin and old bodies

The aged body has been deconstructed as an economic and political category of difference and discrimination and as the site of the mediation of personal identity and selfhood (Basting, 1998). The physiology of the aged body seen not as the determinant of social interaction, but as an envelope of capability that is more properly understood as contained within economic relations and embodied through socialisation into role and expectation.

‘As a socio-historical ‘object’, the body can no longer be confined to biological determinants, to an immanent, ‘factitious’, or unchanging social status. It is a political object par excellence; its forms, capacities, behaviour, gestures, movements, potential are primary objects of political contestation. As a political object, the body is not inert or fixed. It is pliable and plastic material’. Grosz (1987: 3).

Cultural production, conjoined with economic and social discipline, is fundamental to the construction and maintenance of social difference and its incorporation into the psyche and fabric of individual identity and life. Imagery, no less than text, ascribes and re-inscribes as it articulates social observation and commentary (Covey, 1991). Mary Dove writes, ‘representations of the sequence of the ages [childhood, youth, maturity and old age] were,

as medieval philosophers understood them, more than just codifications of the body's growth and decline. If interpreted aright, they could be seen to contain within them truths about man's inner-most nature and spiritual development' (Dove, 1986: 47). Different ages were associated with different balances of the four somatic humours and different mixtures of moistness, dryness, heat and cold. Old age was moist and cold – female attributes - characterised by phlegm humour.

In the late eighteenth century a fundamentally different model of the body began to emerge that fractured early Western understanding of the aging body's placement within a web of universal forces, imbued and shaped by theological and moral principles. The astrological reference is reduced, but the importance of the bodily environs is evident. In 1724, Sir John Floyer wrote,

The cold and dry old Men are shortest livers, because their natural Heat and Circulation is decayed; they want for Nutriment, which makes them dry, and the natural Heat decays for want of a brisk Circulation...The florid and fat old men then are of a sanguine Constitution, and preserve that Temper, by avoiding all Excesses in the hot and cold Regimen. They are the most healthful, and I reckon them in the middle of the acrid, choleric, and salt tempers, which abound in the thin, hot old Men, and the pituitous and serous Humors and Slime, which appear in the cold, fat, pale, old Men (republished: Floyer, 1979).

By the end of the eighteenth century, aspects of the body's aged pathology are empirically assessed, classified and constructed symptomatically – these are the early steps in the medicalisation of the cultural inflection of aging. Benjamin Rush, in 1789, lists the particular problems of *the old*; sensitivity to cold, increase in appetite, fuller pulse, shorter memory, imperfect sleep, pains in the bones, shortness of breath, constipation, giddiness, deafness, colic, piles, intermittent fever and behavioural aspects of a second childhood (Katz, 1996: 35). In Foucault's 'The Birth of the Clinic' (1963) the beginnings of professionalisation and control through signification systems that delineated and defined the aged body are explored. Intervention within the physiological interior is contrasted with earlier interpretative

paradigms. Stephen Katz's study of the 'medicalisation' of old age during the nineteenth and early twentieth century is strongly informed by a Foucauldian perspective. His analysis demonstrates how the emerging scientific, anatomical investigations did not 'discover' the aged body, they helped to create it. The 'medical binaries of healthy/sick and normal/pathological were used to organize bodily life as the basis on which numerous types of people could be classified, studied, problematized, and assisted...medicine does not repress human nature but produces it through specific discursive practice' (Katz, 1996: 27). *Senility* now refers to a pathological state of incompetence. In the seventeenth century *senile* meant what was suited to old age, derived from the fifteenth century *senectitude* originally simply meaning older age. The physicality of the body, site of medicalised degeneration, decay and incapacity, came synonymatically to define older age.

Older age has been both celebrated and demonised in art. For every historical account of the deference and respect paid to aged people and their civic responsibility and influence, there appears to be an alternate description of descent into incapacity and begrudged dependency on the charity and goodwill of offspring (Featherstone, 1995). There are many works that attest to the wisdom, generosity, dignity and the familial and political authority of their older subjects. In contrast, George Richardson's eighteenth century work on Western iconology noted, definitively, that old men personify winter, the cold north wind, misfortune, custom, treachery, and timidity; whilst old women represent drunkenness, avarice, malevolence, melancholy, envy and longevity (Richardson, 1794). Whilst the sharpness and specificity of such symbolism of the aged has faded, it has been gradually replaced by a virtual social, artistic and civic invisibility (Blakie, 1999). To be old in Western culture is to be assumed to be unproductive, to be financially and socially burdensome, allocated the margin and denied aesthetic regard, to be – in varying degree – incompetent.

Herbert Covey (1991) notes that imagery of the aged, from all periods, provides a window on this machinery, illuminating the cultural ground of portraiture and the functions of media such as photography or painting. As with the portrayal of subordinate races, women and socially marginalised groups such as transgender, lesbians and gays, imagery casts an incisive light upon the pillars and fundamentals of social value and power. Baldung's painting, *Illustration 4.3.1* below, offers an early example of the displacement of age. Supplications to the achievements, power, wisdom and dignity of the aged have co-existed, since a Greek and Roman times at least, with anger and exasperation over their dependency, fear of the magic of the hag and the witch, and unease with infirmities of the body and mind (Thane, 2005). It seems as if there is always something a little challenging about looking closely at the aged. First hand contemporary and historical accounts are clear that the antipathy is real. It might



Illustration 4.3.1 'The Seven Ages', 1544
Hans Baldung

be that old age is contagious or it's possible the social avoidance is a politeness, a courteous reluctance to intrude into private grief. Or perhaps it's more visceral, an innate avoidance of sites of deterioration and decay.

Much photographic representation of the body appears as social reportage, exotica, sexual voyeurism – whether licensed as art or otherwise – or 'reclamation'. From the very earliest development of photography, from Hill & Adamson and the Annans through to Hines, to Bill Brandt and on to contemporary journalism, there has been an energetic tradition of photographic enquiry and report into the 'condition of our people'. In more recent times, Martin Parr, for example, has produced perceptive, not to say cruelly incisive, series that might almost have been commissioned for the very purpose of illustrating Bourdieu's analyses of taste, class and the distinctive body (Parr, 2013). Equally strong has been the practice of presenting, for close inspection, the body as curious or exotic, from colonial documentation to Richard Billington's portraits of his family (2000), for example. Much of the work of Diane Arbus (2011) and Nan Goldin (2012) could be accommodated in this category, along with Mark Story's more recent study of centenarians (Story, 2005). My fourth category, that of the reclamation of the body, has been a site of intense political and social action over the last forty years, as many feminist, black and queer statements have sought, in part successfully, to challenge definitions of the acceptable and legitimate body. 'The body has come to be recognised as a contested terrain on which struggles over control and resistance are fought out in contemporary societies... The physical body seems to provide a locus and a focus for the affirmation of identity' (Hancock, 2000: 5).

A critical practice has been the interrogation of cultural stereotypes of beauty and corporeal aesthetics - with their accompanying differential ascriptions of physical capital (Bourdieu, 1986) - and the challenges to the use of the body for the hegemonic production of difference. It has been a feature of some performance art, from at least the Dadaist period, that the body

be abused in some form either as direct political action or as cultural critique – Hannah Wilke and Carolee Schneemann, for example. Outside the documentary and vernacular domains, however, theorised photographic portraiture of the ‘realisms’ of age, appears relatively unexplored within contemporary discourse, though Feminist explorations of the personal experience of aging produced powerful gendered accounts of cultural body imaging and social marginalisation (Browne, 1998; Basting, 1998; Friedan, 2006). The presentations and



Illustration 4.3.2
Used with permission

Outrageous Agers 2002
© Martin & Goodridge

performances, for example, of Outrageous Agers, *illustration 4.3.2* above, sharply illuminated the misogyny of male presumption (Martin, 2002).

Exhibitions of photographs of the aged body enjoyed a relatively brief flowering a decade or so ago, an indirect accompaniment to the sociological and critical theory interrogations of 'ageism' and the production and inscription of social difference through which it was maintained. Anastasia Pottinger, for example, offered a series of portraits of centenarians (*Illustration 4.3.3, below*).

Sufficient works have been produced and exhibited for different registers to become identifiable. What might be termed 'ethnographic studies' present, with almost colonial



Illustration 4.3.3
Used with permission

Centenarian Series
© Anastasia Pottinger

overtones, documentary evidence from their journeys. Several authors have presented embodiments of age, so that *its condition might be known to us*. Manabu Yamanaka's nude studies of old women are powerful examples, as are Donigan Cumming's *'Harry's Diary'*



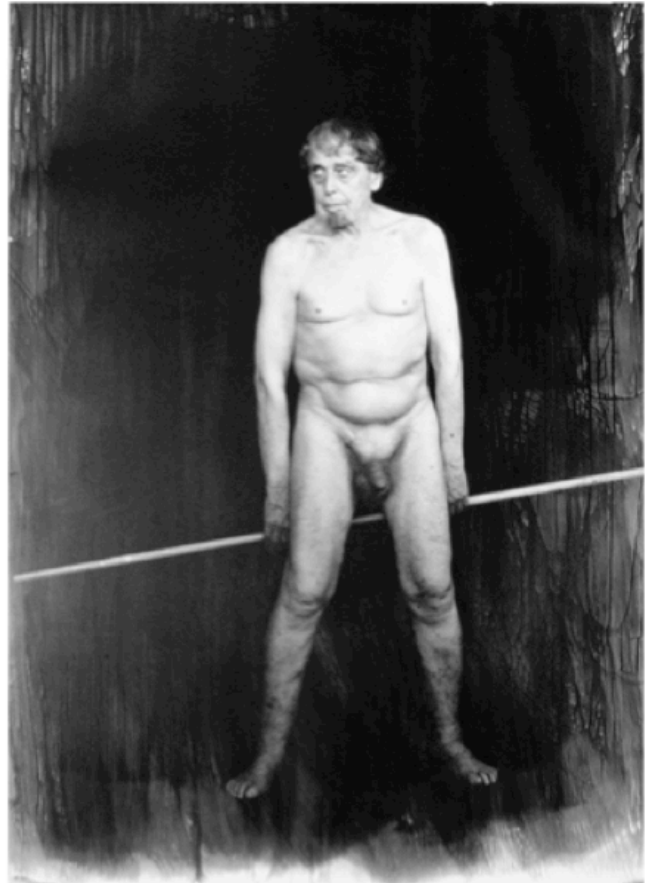
Illustration 4.3.4
Used with permission

Harry's Diary 2002
© Donigan Cumming

series, *Illustration 4.3.4* above, and Nicholas Nixon's '*C.C. Boston*'. Jacqueline Hayden introduced the heroic and the exotic into her *Ancient Statuary* and her *Figure Studies* series, *Illustration 4.3.5* below. The statuary figures are digital composites, platinum/palladium



Illustration 4.3.5
Used with permission



Statuary and Figure Studies series
© Jacqueline Hayden

printed, and the figure studies are large-scale silver gelatin pieces offered to 'challenge culturally sanctioned ideas of beauty/youth and image' adopt more traditional styles of documentation. Of four recently published studies of centenarians, three privilege the identity and presence of the subject – for example David Bailey's 2014 series of portraits, *Illustration 4.3.6* below, and the works of Sally Peterson and Karsten Thormaehlen. In contrast, Anastasia Pottinger, *Illustration 4.3.2* above, presents anonymous skin that, despite its close focus, allows for empathetic rather than solely voyeuristic engagement.

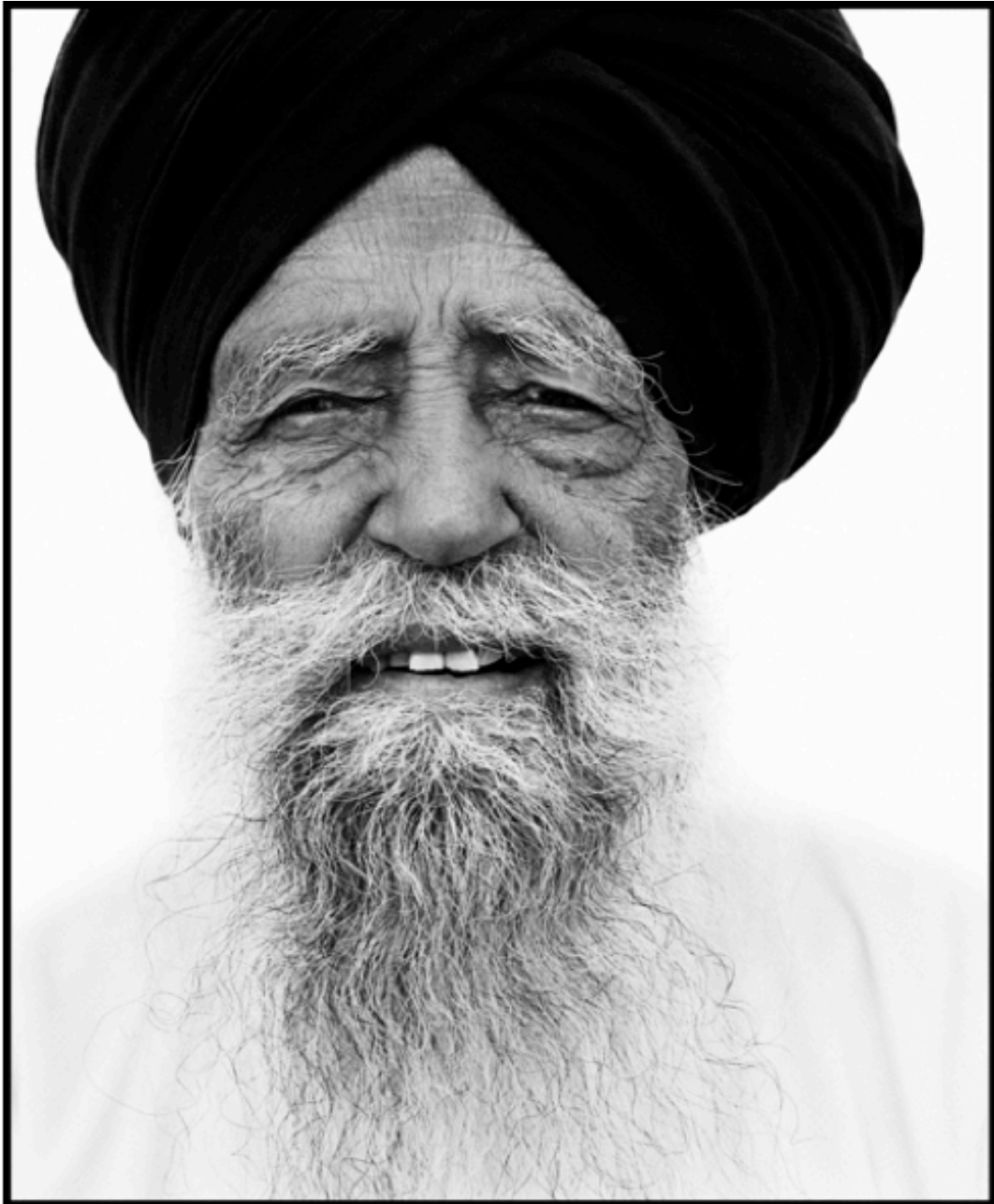


Illustration 4.3.6
Used with permission

Fauja Singh 2014
© David Bailey

Including John Coplans' monolithic self-portraits and Melanie Manchot's first series of her mother (*Illustration 4.3.7* below), monochrome treatments of the skin and the older body have predominated, with three major artists choosing wet-chemistry over digital production. Manchot and Hayden chose to employ hand-processing, using techniques of production, with



Illustration 4.3.7 'Mrs Manchot looking up'
Used with permission © Melanie Manchot 2000

some deliberate 'distressing', that allowed for the materiality of their prints, as well as their scale, to work with the audience.

Without the actual prints available for inspection, commentary on these pieces must be limited to the content appearance and visual poverty of low-resolution reproductions. Nevertheless, something of the signifying resource (Kress & Van Leeuwen, 2006) of the monochrome treatment is evident. In the absence of environmental cues, the chronological placement of the photographic events is more opaque; even with 'straight' portraits the images offer more generalised than particular statements, the distanced indexicality giving permission to engage more with the condition rather than the individuality of the subject. The



Illustration 4.3.8

Google screen grab

'screen grab', *Illustration 4.3.8* above of the first four lines of a *Google* image search, coincidentally including images by Peterson and Thormaehlen, evidences the affective power of smiles, eye-contact and colour, prompting contrasting narrative and engagement around personality and history of smiles, eye-contact and colour, prompting contrasting narrative and engagement around personality and history.

Whilst the artists came to their projects from a wide variety of backgrounds, it is noteworthy that many of their works were presented as large-scale monochromatics, frequently hand-worked or self-printed. Jacqueline Hayden and Melanie Manchot (*Illustration 4.3.7*, above) offered life-size, manipulated images, for example, whilst John Coplans' Frieze series included pieces over three metres tall, It may be concluded that the authors wanted to make an overt, not to say clarion, statement. As if breaking the taboo on the public display of naked old age wasn't sufficient to register viewer attention, they choose techniques of production that

allowed for the materiality and individuality of their prints, as well as their scale, to work almost viscerally with the audience.

Other very large, spectacular pieces were also being shown at this time, but the contrast with the images of old age is instructive. Many of the large works by Jeff Wall and Andreas Gursky, amongst others, are cinematographic in inspiration and effect. Shown on powerful light boxes, the surface of the image is invisible, the picture projected in such saturated colour and enhanced clarity of definition that it becomes a virtual surround-a-vision. For such large physical installations, they have remarkably little 'materiality' or physical presence. In contrast, the photographs of old age, almost irrespective of their content, appear to effect their magic differently, the haptic of the skin and corporeality of the flesh, somehow magnified in monochrome. The worked surfaces of the print and its substrate, including Coplans' silver gelatine pieces, offering a physicality of presence difficult for the experiential body to ignore.

Coplans compares this with his urban social presence.

'You don't exist. If you go out on the streets... and you walk around, and you go in the stores, if you're an old person you don't exist. They don't want to have anything to do with you, because you're ugly, and old, and you're going to die soon, and they don't want to be like that. So you hardly exist' (quoted in Townsend, 1998: 97).

4.4 Professional practice – personal statement

At root, skin appears to hold just six cultural tropes of signification: the invisible, immaculate skin of purity, youth, erotic desire or status; the experienced if not unblemished skin of the lived or wise life; the damaged skin of accident, stigmatum or, more recently, intention; the distressed skin of wickedness or self-indulgence; the decrepit skin of poverty, illness or age; and, finally, the encrusted, impastoed or defaced denial of skin, flayed celebration of the rawness of exposed flesh and psychic or structural nakedness. The many cross-cutting

distinctions available – for gender, ethnicity and status for example – leave the portfolio of the skin rich in nuanced and expressive possibility.

In my professional practice, I reflect upon the resonant skin of older age. I wish to make the physicality of people more accessible, their variety more curious, their experience more evident, their skin and bodies sources of phenomenological enquiry and sensuous interest.

I do not propose gerontophilia nor, as some counter-cultural exemplar or commercial advertisement, promote role-models of vigour and achievement. I aim primarily, through the imprinted *imago* of presence, to provide the opportunity to gaze – objectively, voyeuristically, elegiacally, scopophilically, wonderingly or pityingly – and to engage, albeit briefly, with another's and hence one's own condition (Kellett, 2015). This requires the works to be disclosive as well as evidential, testament as well as testimony. The performance of the print has particular saliency here. Its cultural potentialities rest on the twin significations of process and material: how the technologies are read for production and cultural values, and how the materialities of the print modulate, perhaps extend, meaning. In both regards, early processes contact-prints privilege the discursive over the evidential, eliding the particular into the general, loosening the ties of indexicality.

Early photographic contact-printing processes can exhibit an aesthetic and stylistic 'richness' of presence that is missing from some modern prints. Their characteristics, qualities and cultural connotations are distinctive. Platinum, gum, collotype, photogravure and carbon prints, for example, exhibit individual, quite particular 'look' and 'style' of presentation. They offer markedly different opportunities for interpretative reading. Each process characteristically facilitates or inhibits authorial possibilities for surface texture and relief, image density, tonal range, colour and brightness; they have, in short, their specific *feel* and *presence* when performed as works on paper.

My prints aim to depict the humanity and scale of presence of subjects who, with dignity, offer intimate and voyeuristic access to their embodied selves – contribution and partnership, if not performance. The images are made conjointly; the expressive, if not decisive, moments arising as my sitters explore and experience their naked corporeality and presence and decide what articulations of themselves they wish to make available for record. At these points in the sittings, I rarely provide intrusive or direct instructions regarding pose or posture or visual engagement with the camera equipment

In my practice I seek to avoid objectified representation. I try to incorporate and foreground the agency, self-awareness and complicity of my sitters, acknowledging their construction of the images. At the same time, by denial of socio-economic placement, and dress, I hope to offer enhanced space for the emergence of the viewers' engagement, unconstrained by ascriptions of identity, class, status or authority. As practitioner my research aim is to develop and exploit, experientially and technically, the material prospects of these processes. This is a search for creative articulation and technical innovation. There is, I believe, something about the skin and the body of subjects, in their physical and metonymic presence, that I can express through the material-syntax of these techniques. My conceit is that the *objectness* of the print properly and reciprocally returns the presence of the sitters' *performance* for the camera.

My works seek to re-present mainly, but not exclusively, older subjects for shared intimacy and acknowledgement. The works speak to the compromise and introspection of age – a spectacle and a site of meaning. My sitters' authenticity and accessibility of participation warrants engagement that does not commodify or objectify but respects their presentations. Contemporary art-photography frequently plays with these issues through ironic commentary and deconstruction of 'identity' and 'reality', most commonly expressed through face-on,

unmediated statement of the roles of photographer and beholder in the presence and explicit complicity of the subject.

There has been a fashion in art-photography – Thomas Ruff's 'Portraits' for example – for these fictions to be made explicit (Fried, 2008). Acknowledging this discourse, my research practice, privileging physical above social construction, seeks an intimate and unrehearsed reciprocity. I wish, through printed performances of the envelope of skin, to heighten the haptic of surface, texture and dimensionality, to provide space for narrative awareness of the presence of my subjects, complimenting their explicit complicity and gift of accessibility.

The Appendix to Chapter Eight contains photographic reproductions of the prints prepared for exhibition as part of the 'practice-based' elements of this research.

Chapter Five

The performance of the print – material matters

'The more the picture is kept on the surface of the paper, the more brilliant is the effect, and the more perfectly is the detail, especially in the halftones.. anything like soaking the solutions into the paper produces a flat & unsatisfactory effect'.

George Shadbolt, (1855: 256)

'The rough and unequal texture throughout the paper is the main cause of the calotype failing in details before the Daguerreotype ... and this is the very life of it. They look like the imperfect work of man and not the much diminished perfect work of God'.

David Octavius Hill, 1848. (Quoted in Ford, 1976: 30)

In this chapter I build on the theoretical commentaries in Chapter Three and explore technical and aesthetic aspects of the material performance of early photographic processes – in particular print surface, texture, tonality and resolution – in order to examine some of the ways in which the material and physical availability of the print, simultaneously coded and encoding, may be sentient for viewers. My concern is with what might be described as the photographic *'script'* and its subsequent printed *'performance'* – in other words, with the language, the lexicon, the syntax of the processes and their material properties. The physical characteristics of different types of contact-prints are described in this Chapter. The Appendix (Five) to this chapter provides, in two sections, an historical context and description of key photographic contact-printing processes and supporting empirical descriptions of the material attributes of prints produced on a range of paper substrates. Chapter Six takes these descriptions further and considers ways in which the colourisation of inkjet printed negatives in conjunction with different ultraviolet light sources may help to enhance authorial control over print qualities.

Whilst acknowledging that cultural frames of interpretation and environment shape cognitive and affective responses, the research-led empirical investigations are here conceived primarily

around the physical materialities of the contact-print – specifically, quantitative assessment of attributes and qualitative vernacular lexicons of description. It is hypothesised that, when invited to describe a variety of test pieces, respondents find the material-syntax of the prints experientially salient for their affective response and that their vocabularies are indicative of the aesthetic potential of the print as object. These vocabularies, and the conduct of the exercises, are reported in Chapter Seven.

It is not intended to seek specific correlation or ‘causal’ relationship between particular print attributes, tonal differentiation for example, and verbalised aesthetic appreciation; nor is it intended to categorise or define types of print process in terms of audience descriptors. The designed objective is to discover whether the materiality of the print can function as a ‘semiotic resource’ (Djonov & Van Leeuwen, 2011), rich in experiential potential, that has aesthetic salience for viewers. Texture, reflectance, tonal range and discrimination, acutance, granularity, colour, weight, density and smell, for example, are potent attributes of all physical realisations of imagery; they offer multiplicities of coalition, coding the articulation of affect and cognition. In short, I wish to know whether materiality matters and is affectively pertinent.

The concept of the ‘syntax’ (Crawford, 1979) or ‘channel’ and ‘code’ (Jussim, 1983) may better facilitate an appreciation of the process-dependent materiality of the print if it is extended to recognise not just the technologically dependent variables of technique and interpretation, but also the material expression of culturally shaped artistic intention and execution. A distinction highly relevant to printing processes and commonly remarked in early photography in respect of the treatment of line and tone, is that continuum from ‘expressive’ (*soft*) to ‘objective’ (*hard*) articulation. At the risk of caricaturing differences, greater acutance or edge definition, longer tonal scale and greater crispness and contrast are features of smoother, cleaner, more reflective

and apparently 'mind-independent' print surfaces with potential for detail and precision of visual information, facilitating immediate inference of 'objectivity'. On the other hand, prints with lower definition, with surfaces that diffuse line, tone and focus, offer impressionistic depiction that invites a very different participation from the viewer. Anne Hammond identifies the photographic roots of this distinction in very early practice. 'The two different processes of photography were seen from the beginning as aesthetic opposites. The paper calotype carried with it the "soft" aesthetic of diffusion, while the polished metal daguerreotype gave the "hard" effect of reflection' (Hammond, 1989: 164). She continues,

'Precise definition delivered quantitative information (number of leaves on a tree, or fine architectural details) and the relationship of the observer to the thing observed was relatively objective. The more soft and diffused the surface, the more it referred the viewer to his own contemplative associations; its evocative effect provided qualitative information (depth of shadow cast by a tree, or atmospheric perspective of a cathedral interior) which was subjective or interpretive' (Hammond, 1989: 168).

Given their precision of definition and detail of inclusion, daguerreotypes were appreciated as more literal in their inscription of 'reality'; they display a high and unambiguous information content. Salt prints, by contrast, lacked such detail and acutance, by the very nature of their fibrous calotype negatives and their substrates' absorption of the coatings, they make for *softer* if not *fuzzier* prints whose syntax privileges readings of the expressive and affective. The emerging photomechanical printing technologies of the 1860s and 70s took up positions along this continuum, informing cultural photographic dispositions which resonate still today.

5.1 Language

A primary hypothesis informing this research is the proposition that photographic printmaking articulated through its constituent materials provides avenues of production that are available,

within the parameters of its physical properties, for authorial manipulation and exploitation. The *communication* offered by the print inevitably is mediated by the materiality and mode of its physical realisation (Batchen, 2000; Berger, 1989; Edwards, 2012). In an adaption of Ivins' term, I propose the designation *material-syntax* to indicate the contribution to communicative tone and meaning articulated through the physicality, properties and *objectness* of the photographic print. The inclusion of *syntax*, as an equal partner in this term, allows for a holistic appreciation of individual printmaking channels, acknowledging their systemic register and potential. Just as each type of musical instrument has its particular tone and timbre, so we may recognise in early photographic printmaking 'ways of working' and techniques that are particular and distinctive of voice and register.

Academic consideration of vernacular description of the materiality and use of photographic prints appears relatively sparse, Radley (2010) and Mitchell (2005) excepted. I have found little discussion of the material attributes of photographic production and transmission outside of sophisticated theoretical modelling of the properties of image systems on the one hand, resolution and signal noise in particular, and psychological studies of visual perception on the other. There appear to be few examples of critique or description of photographic prints that makes reference, other than *en passant*, to the tactile properties of the artefact. Discourse on readings of photographs commonly is more concerned with ontological status, formal analysis or signification (Wells, 2003) and frequently disregards the physicality of the object, offering no systemised framework or vocabulary for its analysis, though Elizabeth Edwards (2004) has been very active in encouraging work in this area. Obviously, prints on display in museums and galleries are not available for handling by the public, textuality only can be perceived visually and may be modified by glass or other protective covers. Most vernacular, non-digital, photographic images are held domestically and, presumably, are handled almost as frequently

as they are viewed. The tactile as opposed to visual physicality of these prints is an unknown, but possibly not an insignificant element of the sensory information available to the viewer, conveying haptic indications of provenance, process and value.

Djonov & Van Leeuwen (2011) explore the multi-modality of *texture* as a semiotic resource by developing parameters for describing tactile and visual surface textures and comparing their meaning-making potential. They take up the distinction offered by Kress and Van Leeuwen (2007) between the meanings, particularly value, available from the genesis of the texture – for example, the signification offered by the cultural history of denim – and the experiential resonance from previous contact. ‘Mapping the experiential meaning potential of texture...involves extracting the qualities that will allow a given texture to be described and compared with others. Such mapping is a sensory explanation which not only identifies what these qualities are, but also how they are associated with one or more different senses’ (Djonov & Van Leeuwen, 2011: 547). They categorise visual textuality in three groups: *material qualities* include the continua of relief, density, roughness and consistency; *associated qualities*, descriptors of specific types of objects, include liquidity, viscosity and rigidity; and *symbolic qualities* such as the warmth indicated by warm colours. These visual categories they contextualise against a six-fold organisation of tactile textures – liquidity, viscosity, temperature, relief, density and rigidity – structural but not vernacular categorisation.

Clearly articulated conceptual frameworks and appropriate measuring schema are available and well practised for the empirical and objective assessment of a limited sub-set of the reproductive characteristics of prints, but there is no agreed categorisation or lexicon of terms in commonly accepted critical use to identify or describe phenomenologically significant artefactual features that are potent in the communication of information or meaning. Work by Bhushan *et al.* on

subjects' organisation of words related to visual texture and the identification of underlying dimensions, though, is relevant in this context.

'If language is intimately tied to cognition, then the words we use to talk about what we see may also reveal to us how we internally configure what we see. In particular, the way in which human beings categorize the words and images of a domain such as texture may provide insight into how they internally structure the concepts of that domain' (Bushan *et al.*, 1997: 221).

They note that in contrast to the work done on colour, both in terms of its categorisations and its psychological significance, investigations of surface properties such as texture 'appears to be chaotic' (1997: 221). Restricting their analyses to the visual rather than tactile aspects of texture, they derived three hundred plus descriptors of textuality from dictionary sources. Eliminating words referencing the play of light – *translucent* or *opaque* for instance – they utilised the assessments of volunteers to group the terms within what they describe as 'visually similar' categories. Using multidimensional scaling techniques, they derived eleven primary clusters of surface texture, which correlated well with their earlier analyses of the descriptors used of visual images, and were able to organise the majority of these along the axes of three dimensions: *regular vs. random; linearly oriented vs. circularly oriented; simple vs. complex* (Bushan *et al.*, 1997: 224). The potential affective and cognitive significances of these dimensions were not examined, however, nor the important distinction between actual (artefactual) and implied textures (i.e photographic or artistic two-dimensional representations).

Schema such as these provide a useful sketch of the landscape of visual and tactile textuality. I am interested in Djonov and Van Leeuwen's concept of *symbolic* visual quality which appears to propose a textural equivalent to the indexicality of the photographic *trace*; but descriptive matrices of this nature have the potential, also, for broader considerations of the complementarities and discontinuities between the physical textuality of the print artefact and

the depictions of visual texture that can be achieved by the reproductive process. Photogravure representations of the skin of the face, for example, may carry *symbolic* qualities that in terms of aesthetic properties play very differently in portraiture of the aged compared with that of the young.

5.2 Material-syntax – the quantitative lexicon

5.2.1 The processes

The photographic processes selected for examination are broadly representative of amateur and commercial techniques and technologies in use in the latter half of the nineteenth century. They do not include those of mass-production printing, but are representative of those non-industrial production processes that allow opportunity for the exercise of handcraft and authorial skills in print production. Platinum, salt and cyanotype prints are formed from photosensitive coatings that lie within the surface of the substrate. Albumen and carbon-transfer prints are formed on surface coatings that sit on top of the substrate, and photogravure images are produced by inks pressed into the fabric of the substrate. The contact-printing processes and contemporary inkjet reference example include:

- Platinum/palladium
- Salt and albumen
- Polymer-plate photogravure (as a modern proxy for copperplate gravure)¹
- Cyanotype
- Carbon-transfer
- Digital inkjet included for purposes of reference and comparison

The operational processes, as employed for these investigations, are described in Appendix Five to this Chapter, but in summary the contact-prints are produced as follows. Cyanotype, Platinum/palladium and Salt/albumen processes require the application to a suitable substrate,

¹ Polymer plate gravure provides a more practically convenient and, aesthetically, equivalent result for the production of intaglio prints

usually paper, of photosensitive chemical mixtures that are proportionately reduced by exposure under a suitable negative transparency to ultraviolet light to very finely divided opaque material that forms the body of the image. Cyanotypes and Platinum/Palladium prints are *siderotypes*, their active agents sensitive to ultraviolet light are iron compounds (Ware, 1999). The photosensitive coating for Cyanotypes is a mixture of Ferric Ammonium Citrate and Potassium Ferricyanide producing Ferric Ferrocyanide (Prussian Blue) under the energy of UV light. Unexposed and by-product chemicals are washed away during development in water baths leaving the blue image embedded in the surface paper fibres.

Platinum and Palladium metals are relatively inert and not as susceptible to environmental degradation as silver prints (Arendtz, 2005). Platinum salts produce more neutral black tones whilst Palladium salts render warmer brown images. It is common, on account of the cost of Platinum, for a mixture of the metal salts to be used – normally in the form of Sodium Chloropalladite and Potassium Chloroplatinite. An aqueous solution of these salts is combined with a solution of Ferric Oxalate to coat the substrate. Exposure under negative transparency to ultraviolet light proportionally reduces the salts to finely divided metals which form the image on development with aqueous Potassium Oxalate. Unwanted by-products are cleared from the print in dilute acidic washes.

Salt and Albumen prints are produced using similar techniques (Reilly, 1980). Their photosensitive chemical is Silver Chloride, reduced on exposure to UV to very finely divided silver metal. Silver Chloride is precipitated in the paper-substrate fibres by sequential aqueous coatings of Sodium Chloride and Silver Nitrate. In the case of Albumen prints, the initial salt coating is combined with denatured egg-white which can provide a glossier appearance to the final print. After exposure, by-products and excess silver salts are removed in water baths.

The photo-active constituent of the Carbon-transfer process is Potassium or Ammonium Dichromate, applied in aqueous solution (Hannovey, 2008). This is used to sensitise a substrate coated with a thin layer of pigmented gelatine – referred to as ‘carbon-tissue’. Originally the pigment would have been carbon from lamp soot, hence the title, but stable finely divided pigment of any colour may be used. On exposure under a negative transparency to ultraviolet light, the dichromate acts proportionately to ‘harden’ or ‘tan’ the gelatine colloid-matrix. This has the effect of raising the melting point of the gelatine layer proportionately according to the amount of exposure allowed by the negative. After ‘mating’ with a separate *receiving* paper, the sensitised and exposed substrate can be stripped away, as the unexposed gelatine on this original transfer-tissue melts in a warm water bath, leaving the image remaining on the receiving paper, formed from the differentially hardened pigmented gelatine.

The carbon-transfer process may be employed also to prepare copper etching plates for intaglio printing (Hannovy, 2008). Instead of transferring the sensitised and exposed carbon-tissue (in this process under a positive transparency) to a receiving paper, the tissue is transferred to a copper plate. Following removal of the tissue substrate and unexposed gelatine in a warm water bath, the transferred hardened gelatine-matrix on the copper surface provides a ‘resist’, allowing processing through ferric chloride baths to etch the image into the copper surface. Previous application of an aquatint resist ensures that the etching does not produce excessive or ‘foul-bite’ in dark shadow areas. This copper-plate process is very time consuming and use of photosensitive photopolymer plates provides the more convenient and environmentally friendlier method of producing intaglio etching plates and was adopted for this research project. Photopolymer plates are ‘hardened’ by exposure to UV light, as with carbon transfer, but subsequently etched by development in water rather than acid or ferric chloride. An aquatint

protection for the shadow areas is provided by an initial exposure under a fine stochastic screen (Longley, 1998).

5.2.2 Material properties

Prompted in large part by the requirements of the photographic and digital imaging and printing industries, a great deal of research over the last sixty years has been undertaken on the conceptualisation and operational measurement and control of the print 'quality' (Keelan & Cookingham, 2002). Conventionally, assessments of quality are now made against standard *origination targets*. In other words, it is usually the case that fidelity of reproduction, not creative possibility, is the goal of production and focus of industrial research. This concern with quality of reproducibility against a defined standard permits both the reliability and validity of operational parameters to be calculated objectively. In his comprehensive work, Lindberg (2004) identifies twelve fundamental descriptors, commonly employed by the industry, that define print production against given standards:

Lindberg's dimensions of print production quality		
<i>sharpness</i>	<i>contrast</i>	<i>detail shadows</i>
<i>detail highlights</i>	<i>gloss levels</i>	<i>gloss variation</i>
<i>patchiness</i>	<i>mottle</i>	<i>noise</i>
<i>colour gamut</i>	<i>colour shift</i>	<i>tone quality</i>

Because these quality indices are generally applied to halftone relief printing (where, on a uniform substrate surface, only the size, shape and frequency of each dot are varied and the ink density remains constant), this listing makes no specific reference to attributes that I presume to be significant in the textural and other aesthetics of print materiality. Attempts, therefore, to apply the full range of standardised industry procedures to secure comparisons of early-photography and photomechanical print processes are probably unhelpful, not least because there is no such thing as a 'standard art-print' in the way in which there may be said to be

standards for newspaper reproduction of a photograph. Creative articulations of images are not necessarily to be defined by standardised notions of resolution or tonal differentiation. Nevertheless, industry practice in the description and management of print qualities offers tested methods of print comparison – for example, to distinguish the key and inter-related attributes of ‘sharpness’, ‘acutance’, ‘resolution’, ‘contrast’ – some of which can be adapted and utilised for this project. In lay terms, the *resolution* of a printing system refers to the extent to which detail can be discerned, usually expressed numerically as the number of line pairs per mm (lppmm) that are discriminated. It is conditional upon edge *acutance*, that is the blurriness of the junctions between the lines, on the tonal *contrast* across these boundaries and upon the interference of random ‘signal-noise’ or process imperfections.² The total articulation of print *sharpness*, and perceptions of it by viewers, is by no means a straightforward or easily quantifiable matter to assess.

Traditionally industry research in photography, optics and more recently video imaging, has taken this ‘resolution of detail’, alongside colour management, as one of the key issues, particularly in the development and marketing of film and lenses, and sensors, screens and projectors. Techniques for objective/machine measurement of ‘sharpness’ as ‘*Modulation Transfer Function*’ (MTF) have reached operational maturity (Williams, 1989:20). Recognition of the importance of subjective assessments has been formalised through the investigation of the eye’s ‘*Contrast Sensitivity Function*’ (CSF) and articulated as the ‘*Subjective Quality Factor*’ (SQF) incorporating MTF and CSF (Shannon, 1997), accommodating the effect of viewing distance and print height – though not, as far as I am aware, viewing context or environmental factors. Current conceptualisations and operational practice embrace the totality of the ‘*imaging system*’ and

² The degree of noise, for example, in a cyanotype print is likely to be much higher than with carbon transfer due to irregularities in the substrate absorption of the cyanotype coating.

acknowledge the individual and cumulative contributions of all system elements in the qualities of image capture and reproduction – lens, sensor, digital manipulation, monitor or print realisation, human physiology and psychology – but acknowledge few if any cultural or semiotic conventions of interpretation and meaning.

There is evidence available, for example from photographic industry studies, that, overall sharpness aside, observers prefer images with the largest number of perceived grey levels (Calabria & Fairchild, 2003) or ‘just-noticeable differences’ (Lee, et al. 2012).³ These findings are supported by psychological/physiological investigations into compositional preferences (Niekamp, 1981; Palmer *et al.*, 2008). Interestingly, in one study, perceived image contrast scales were found to be image independent across five pictorial images, but significant contrast differences between images of identical white and black points were perceived by respondents, demonstrating that image white and black points do not solely determine perceptions of image contrast (Calabria & Fairchild, 2003).

In my appropriation of the industry lexicon to develop descriptors of ‘fine print’ materiality, I have adopted attributes that I believe are expressive of specific process characteristics and craft manufacture, namely:

- resolution
- maximum reflectance density (i.e. the darkness of the shadow areas in the print)
- range and differentiation of tonal scale (darkness-lightness scale, and degree of discrimination within similarly toned areas)
- glossiness and surface texture
- mottle

³ The "*Just Noticeable Difference*", or Difference Threshold, is the minimum amount by which stimulus intensity must be changed in order to produce a noticeable variation in sensory experience. Ernst Weber, 19th century experimental psychologist, observed that the size of the difference threshold appeared to be proportionate to the magnitude of the initial stimulus.

I have omitted those attributes more indicative of consistency of mass-production such as gloss variation, colour gamut and shift. The colour tone of the prints is briefly described but not measured.

Properties of the paper support or substrate, for example *colour, texture, brightness, and weight*, are also major contributors both to viewer appreciation and response and to the qualities of reproduction. There is evidence that the substrate, usually paper but also glass or plastic, strongly affects the achievable resolution and perceived sharpness of the print (Inoue *et al.*, 2000). Resolution and tone reproduction characteristics are affected by the ways in which light scatters in the paper, in turn mediated by the surface coatings of the print process. Accordingly, my choice of variables for this section of the research is informed by presumptions of their cognitive and affective potential (Morovic and Nussbaum, 2003) and includes print substrate as well as print process variables, namely:

Substrate attributes	Printing process attributes
Surface texture	Reflectance density range
Colour	Resolution
Brightness	Tonal gradation and differentiation
Feel	Surface texture production
Thickness	Gloss
Weight	Colour

Examination of these attributes forms the basis of the empirical investigations reported below and in Chapter Six and the Appendices to these two chapters. The differences between light reflection, absorption and scattering from the print process' pigmentation and the reflection (or glossiness) of substrate coating, calendering and texture – of potentially aesthetical significance – are evaluated by pre and post-production measurements. Surface textures and the absorption/layering of photosensitive coatings are illustrated by micrographs.

5.3 Quantitative description – *Phase A*

The experimental protocols adopted, as *Phase A* in this chapter, provided for the description of the surface characteristics and print reflectance densities, image contrast, tonal discrimination and detail resolution of selected paper substrates and printing processes. Reported as *Phase B*, in the following Chapter Six, these variable were examined further to compare the effects of different colourisations of inkjet negatives and selected UV illumination sources.

There is a great variety of paper substrates commercially available that can be used for contact printing with early processes, each with different composition, sizing and finishing that potentially moderate significantly the qualities of the final print. A selection from commercially available paper was made to keep the exercise within practical bounds. Production of early process prints is effected by the operation of a large number of factors besides the paper support and its pre-treatment, these include:

- type and nature of negative substrate – digital inkjet negatives, the type of printer, printer driver and inks, and film density and grain structure
- spectrum and power of ultraviolet exposure radiation
- coating of photosensitive chemistry – constitution, quantity and evenness of application
- moisture content of coated paper before processing
- environmental humidity and temperature
- image development treatments
- post-process treatments, such as waxing or varnishing

In evaluation of print materialities, this research makes no attempt to quantify the value to the viewer of these process variables, but seeks simply to provide empirical descriptions of finished prints as deployed for qualitative assessment (Chapter Seven).

5.3.1 Phase A – Protocol

Based upon their availability in the UK and type of surface treatment and sizing, a sample of papers that were reported as suitable for early process contact-printing (Fabri, *n.d.*) were selected for description in this initial Phase. From this sample, two papers of contrasting types – Arches Platine and Fabriano Artistico – were taken forward for more extensive investigations exploring the effects of different UV sources and colourised negatives (*Phase B*, Chapter Six).

The twofold purpose of *Phase A* was to describe the characteristic print attributes of the different processes and to provide base-line information about the changes in paper surface characteristics due to processing procedures – coating, drying, exposure, soaking and drying – that might occur independently of any variations in the colourisation or production of the inkjet negatives. For these preliminary descriptions, the selected papers were coated by rod draw-down method with 1ml of sensitising solution per 250 square centimetres for the salt and albumen, platinum/palladium and cyanotype processes. To ensure consistency, commercially available pre-prepared tissue (*Bostick & Sullivan*) was used for the carbon-transfer printings and *Toyobo Printight KM73* photopolymer plates for the photogravure. All exposures for the production of the test prints for *Phase A* were made on a vacuum exposure unit using a fluorescent tubes ‘black-light’ UV source. An LED array and a metal halide bulb were subsequently used as additional sources for *Phase B*.

The sample of different types of papers processed included:

- Arches Aquarelle (*Satine* 300gms weight per square metre, hard finish, hot pressed with strong surface size)
- Arches Platine (310gms, moderate surface size and finish)
- Cot 320 (300gms, moderate surface size and finish)
- Fabriano 5 (*Satine White* 300gms, hot pressed, hard finish, surface sized)
- Fabriano Accademia (240gms, slight texture, hard finish, moderate surface size)
- Fabriano Artistico (*Traditional White* 300gms, hot pressed, hard finish, strong surface size)

- Hahnemuhle (*Etching White* 300gms, soft finish, textured, little surface size)
- Heritage Rag (300gms, moderate finish and surface size)
- Somerset Velvet (*Soft White* 250gms, soft finish, modest surface size)
- Zerkall Printing (*Soft White* 145gms, lighter weight, hot pressed, moderate surface size)

Two film negatives were used for tests (*Illustrations 5.3.1.1* and *5.3.1.2*, below, shown as positive) one constructed from elements extracted from the standard *ISO 12233* resolution target and the second from digitally prepared grid matrices. The negatives contained no half-tones or intermediate tones, and were prepared from vector files by commercial imagesetter. The pixel grid resolution targets were chosen in preference to the *1951 USAF* line-pairs target in order to evaluate the ability of the papers and processes to reproduce the fine detail of cross-cutting lines and the intersections of small squares. The pixel grid also provided a useful target for comparison of inkjet and image-setter productions. An industry-standard transmission 31 step gradation wedge (*Stouffer T3110*) was exposed alongside the resolution targets in order that print density and tonal discrimination could be assessed. None of the many traditional nineteenth century post-process treatments – waxing, pressing or chemical toning for example – were applied and pre-treatments were limited to the gelatine sizing necessary for carbon transfer and albumen sizing for the albumen prints. After processing, each test piece was assessed for reflectance density (i.e. the maximum depth or darkness of tone) and gloss and an evaluation was made of the print resolution using the *ISO 12233* geometric figures and the pixel matrices.

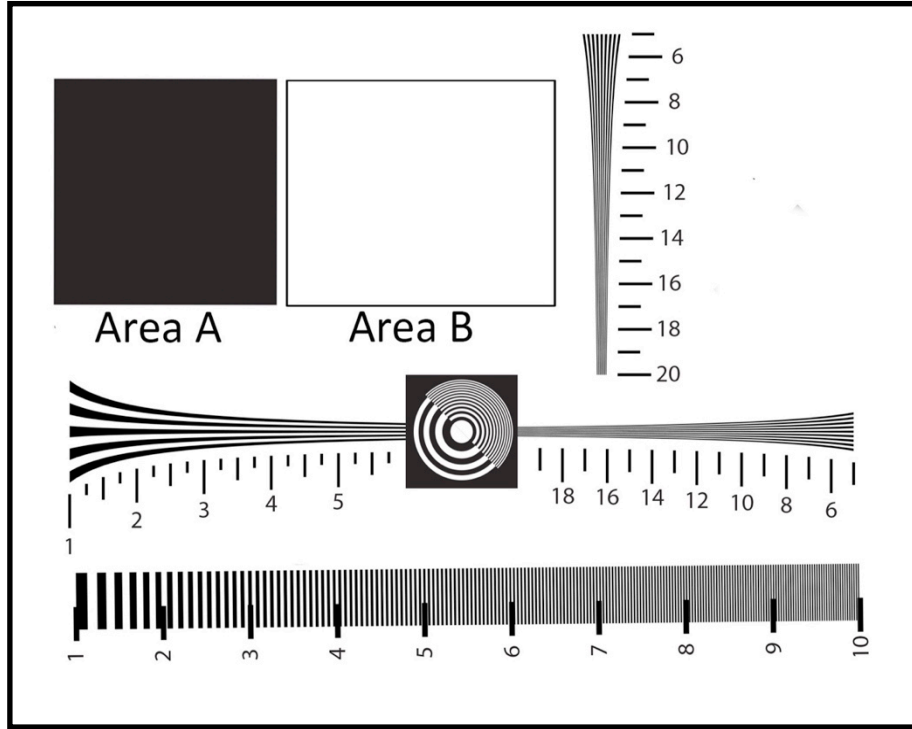


Figure 5.3.1.1 ISO 12233 resolution target extract (shown as positive)

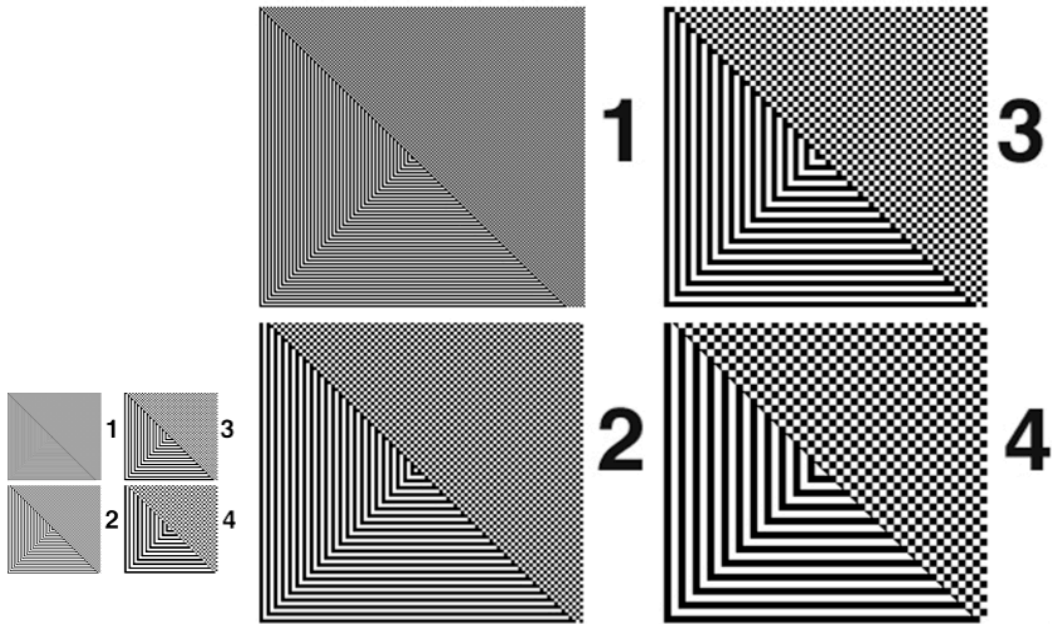


Figure 5.3.1.2

Resolution Test Pixel-Matrices

The matrices grids are formed at 1, 2, 3, & 4 pixel dimensions at 300 pixels per inch. The left-hand matrix is actual size, the right-hand one is enlarged to better illustrate its formation.

Matrix courtesy of Mark Nelson, 'Precision Digital Negatives'.

5.3.2 Phase A – findings

The colour, reflectance density (lightness/darkness) and gloss of the ten paper samples, and inkjet and silver gelatine comparators, were assessed before processing and are summarised in *Table 5.3.2.1*, below. The samples of each type showed variations in readings, the measurements

Paper (unprocessed)	Surface	Colour	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	textured	white	0.05	1.1	5.1	9.5
Aquarelle	very hard smooth	off-white	0.07	1.1	4.3	9.8
Artistico	very hard smooth	cream	0.06	1.1	4.7	9.2
Cot 320	soft smooth	white	0.06	1.1	4.1	7.7
Fabriano 5	hard smooth	bright white	0.05	1.1	4.1	6.0
Hahnemuhle	soft textured	white	0.07	1.4	1.1	3.5
Heritage Rag	soft smooth	white	0.06	1.1	4.5	8.9
Platine	soft smooth	white	0.06	1.1	4.4	8.0
Somerset	very soft smooth	white	0.06	1.1	4.2	4.4
Zerkall	hard smooth	off-white	0.10	1.0	4.4	7.8
Comparators:						
<i>Glossy inkjet</i>	<i>hard smooth</i>	<i>bright white</i>	<i>0.13</i>	<i>28.7</i>	<i>50.5</i>	<i>92.0</i>
<i>Satin inkjet</i>	<i>slight texture</i>	<i>white</i>	<i>0.10</i>	<i>2.2</i>	<i>17.7</i>	<i>42.5</i>
<i>Matt inkjet</i>	<i>very slight texture</i>	<i>white</i>	<i>0.13</i>	<i>1.1</i>	<i>2.0</i>	<i>9.7</i>
<i>Silver gelatine (resin coated)</i>	<i>hard smooth</i>	<i>bright white</i>	<i>0.08</i>	<i>64.3</i>	<i>93.9</i>	<i>63.1</i>

Table 5.3.2.1

Surface qualities of selected paper substrates

shown above, and for the subsequent tables, are averages of three readings for each entry. The samples exhibited similar pre-processing reflectance densities (D_{\min}), but marked differences in surface hardness and texture, evidenced in their gloss measurements. Compared with inkjet and silver gelatine papers, though, all the papers were matt, less than 10% of the gloss values of glossy photo inkjet papers. Albumen printing requires the application of a sizing of egg-whites which (single coated) increased gloss measurements on the hard finish papers to between 10-20% – detailed in the Appendix to this chapter – unsurprising perhaps, given the reputation of albumen prints. All the contact-printing processes required the paper substrates to be soaked in water for prolonged periods. With the exception of albumen and carbon-transfer prints where the size is ‘hardened’ as part of the process, much of the surface sizing was softened and removed during washing, reducing glossiness.

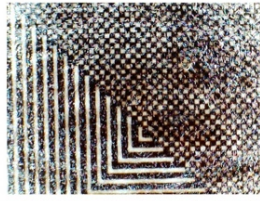
The cyanotype data after processing are shown as an example in *Table 5.3.2.2*, below. Details of the other processes are shown in the Appendix to this Chapter (section A5.3). With the exception of albumen and carbon-transfer prints, the processing treatments reduced what little gloss the papers initially exhibited and rendered all the papers, whatever their initial surface sizing, as completely matt. The majority of the papers did not remain flat and uncockled as they dried, Arches Platine, Somerset, Cot 320 and Hahnemuhle were the exceptions. The lighter Zerkall paper distorted considerable and Fabriano 5 showed uneven bumps and hollows as well as twists and curling. The cockled papers required humidification and storage under weight for a few days before they straightened. Differences were observed in the maximum print density achieved by the papers, due to the differential absorption by their fibres of the photosensitive coating, which strongly affected their evenness of tone or mottling, but the differences varied across the print processes. The smooth hard surfaced papers became slightly roughened and all papers

CYANOTYPE process paper:	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence	Gloss % at 80° <i>before</i> <i>processing</i>
Accademia	1.42	0.06	0.3	0.3	0.5	9.5
Aquarelle	1.46	0.09	0.5	0.6	1.6	9.8
Artistico	1.51	0.06	0.5	0.3	0.6	9.2
Cot 320	1.40	0.06	0.4	1.1	1.7	7.7
Fabriano 5	1.39	0.07	0.0	0.6	0.5	6.0
Hahnemuhle	1.28	0.08	0.4	0.8	0.0	3.5
Heritage Rag	1.41	0.07	0.4	0.8	0.8	8.9
Platine	1.28	0.07	0.5	0.6	1.3	8.0
Somerset	1.49	0.08	0.0	0.0	0.0	4.4
Zerkall	1.38	0.11	0.4	0.8	2.0	7.8

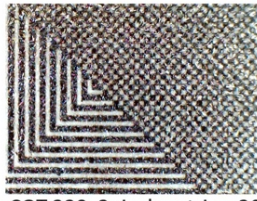
Table 5.3.2.2 An example of paper attributes after processing – Cyanotype

developed raised surface fibres which affected feel to the hand. The soaking/drying procedures made each of the papers somewhat stiffer and less flexible, and possibly less ‘sympathetic’ to the touch.

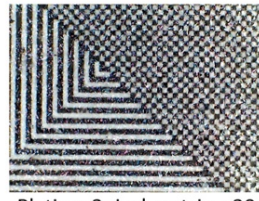
In respect of resolution, the *pixel matrices* proved informative discriminators. *Illustration 5.3.2.3*, below, shows micrographs at 20x magnification of image-setter vector originated 3-pixel matrix (top) and 1-pixel matrix, printed by Albumen process on selected papers. The 3-pixel matrix is



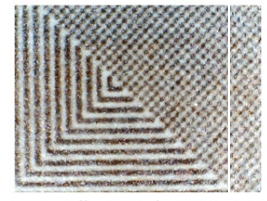
Accademia 3pixel matrix x20



COT 320 3pixel matrix x20



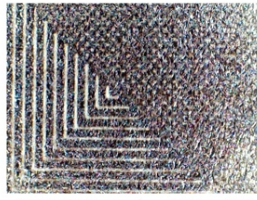
Platine 3pixel matrix x20



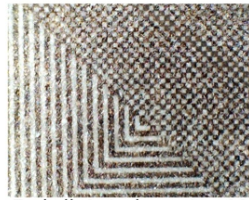
Aquarelle 3pixel matrix x20



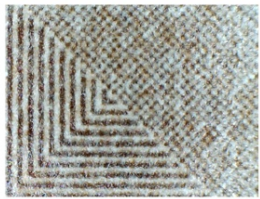
Hahnemuhler 3pixel matrix x20



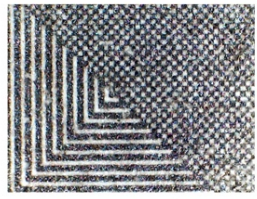
FAB. 5 3pixel matrix x20



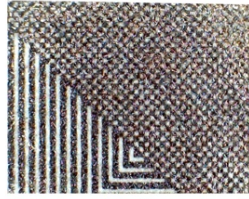
Zerkall 3pixel matrix x20



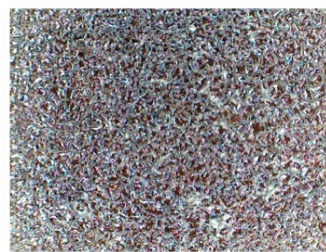
Somerset 3pixel matrix x20



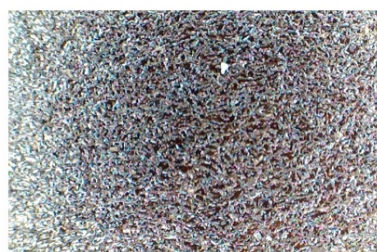
Heritage Rag 3pixel matrix x20



Artistico 3pixel matrix x20



COT 320 1pixel matrix x20



FAB. 5 1pixel matrix x20



Aquarelle 1pixel matrix x20



Artistico 1pixel matrix x20



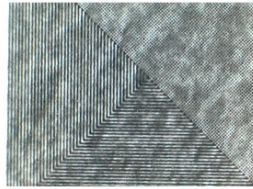
Platine 1pixel matrix x20

Illustration 5.3.2.3

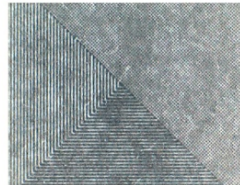
**Micrographs x20 of 3-pixel (top) and 1-pixel matrices
Albumen processed prints – imagesetter origination**

clearly visible on all the papers, though with varying degrees of sharpness and precision, but only two papers were able to print the 1-pixel grid – Artistico and Platine. These examples are not definitive as the prints are hand processed and further printings may produce slightly different results. They are nevertheless indicative, firstly, that the nature of the substrate is important, and secondly that smooth and harder-sized papers are likely to facilitate greater resolution where they can carry a uniform sensitive coating. Printings of the extracted elements from ISO 12233 – the finely divided vertical lines and the converging curved lines – confirmed the results shown by the pixel matrices. The platinum/palladium printings of the imagesetter pixel matrices produced differentiation of 1-pixel line and grid on all papers (*Illustration 5.3.2.4*, below).

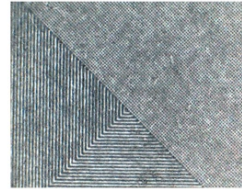
The resolution difference between Albumen and Platinum prints at first sight is counter-intuitive as the the platinum/palladium sensitising chemistry is absorbed into the surface of the substrate, and therefore the resulting image is likely to be diffused within the paper fibres, whilst the albumen chemistry is absorbed into the thin albumen sizing that sits on top of the paper and could be expected to be less diffused. The same chemistry is used for salt printing, the only difference being the absence of a size coating. *Illustration 5.4.2.5*, below shows Salt print micrographs of the imagesetter 1-pixel matrix printed on the selected papers. Again it appears, taken across the whole sample, that the surface-absorbed coating produced clearer delineation of the 1- pixel matrix than did the albumen-sized prints. However, the Albumen matrices exhibited greater contrast between the printed dark lines/squares and the non-printed ‘paper-white’ spaces between that produced an impression of greater clarity and sharpness. *Illustration 5.3.2.6*, below, compares an imagesetter 3-pixel matrix printed as Salt and Albumen on Artistico paper. In many places, the contrast between dark and ‘white’ lines on the Albumen print is over 30% greater than on the Salt print, producing an impression of greater ‘sharpness’ although the



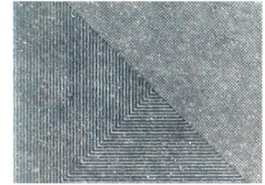
Accademia 1-pixel matrix x20
Platinum/palladium printing



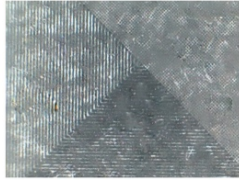
COT 320 1-pixel matrix x20
Platinum/palladium printing



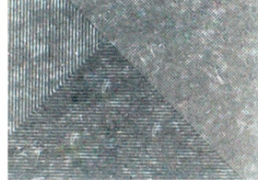
Platine 1-pixel matrix x20
Platinum/palladium printing



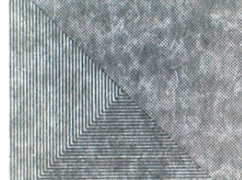
Aquarelle 1-pixel matrix x20
Platinum/palladium printing



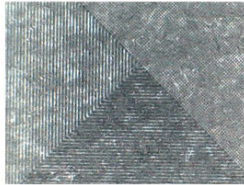
Hahnemuhler 1-pixel matrix x20
Platinum/palladium printing



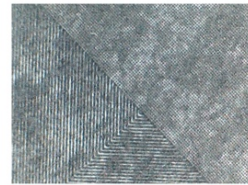
FAB. 5 1-pixel matrix x20
Platinum/palladium printing



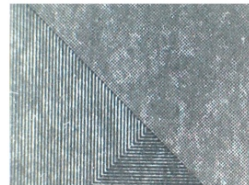
Zerkall 1-pixel matrix x20
Platinum/palladium printing



Somerset 1-pixel matrix x20
Platinum/palladium printing



Heritage Rag 1-pixel matrix x20
Platinum/palladium printing



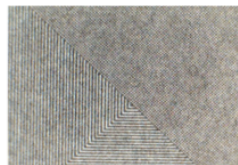
Artistico 1-pixel matrix x20
Platinum/palladium printing

Illustration 5.3.2.4

Micrographs x20 of 1-pixel matrices – platinum/palladium printed
Imagesetter origination



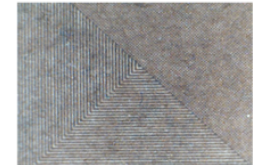
Accademia 1-pixel matrix x20
Salt printing



COT 320 1-pixel matrix x20
Salt printing



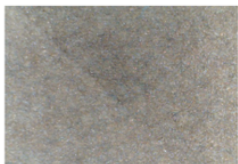
Platine 1-pixel matrix x20
Salt printing



Aquarelle 1-pixel matrix x20
Salt printing



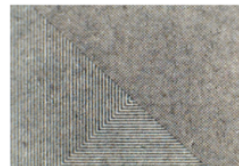
Hahnemuhler 1-pixel matrix x20
Salt printing



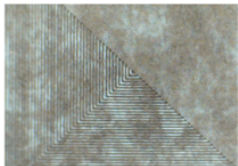
FAB. 5 1-pixel matrix x20
Salt printing



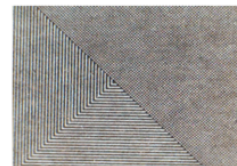
Zerkall 1-pixel matrix x20
Salt printing



Somerset 1-pixel matrix x20
Salt printing gel



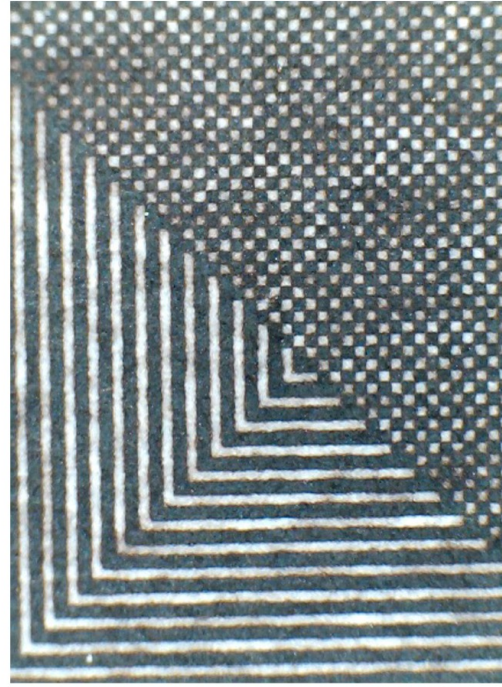
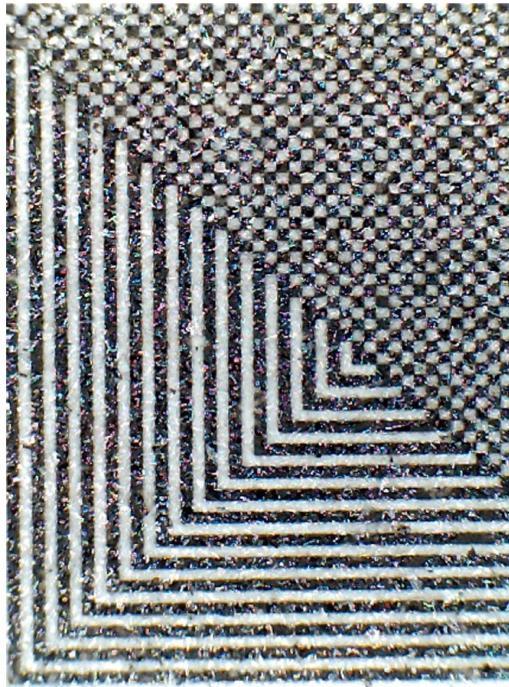
Heritage Rag 1-pixel matrix x20
Salt printing



Artistico 1-pixel matrix x20
Salt printing

Illustration 5.4.2.5

Micrographs x20 of 1-pixel matrices – Salt printed
Imagesetter origination



Albumen Print 3-pixel matrix

Salt Print 3-pixel matrix

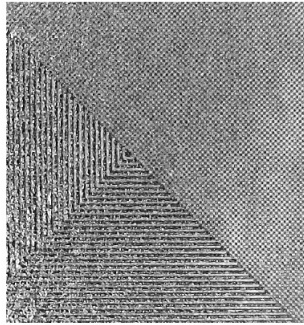
Both prints produced on Artistic paper with imagesetter film

Illustration 5.3.2.6

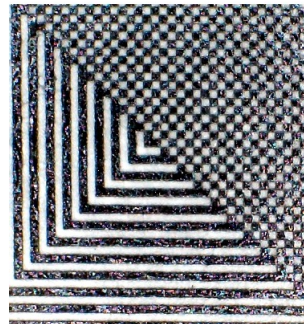
3-pixel matrices - enlarged

resolution of detail is by no means superior. Cyanotype matrices exhibited similar characteristics. On some surface sized papers, Fabriano Accademia and Artistic for example, high degrees of resolution at the 1-pixel level were evident, but differential absorption by the paper fibres and low levels of contrast, coupled with the tendency for the chemistry to bleed from the shadow areas, resulted in apparent lack of 'sharpness'. Illustrations and comparisons are included in the Appendix to this Chapter. The resolution achievable on Carbon-transfer prints is less dependent on the type of paper surface. For transfer of the sensitised and exposed pigmented-tissue to take place successfully the 'receiving' paper must be sized before processing – usually a 3% w/v gelatine solution coating is sufficient. The transferred pigmented-tissue holds the image and it sits on top of the sized surface of the receiving paper. The paper substrate's attributes affect the character of the final print less strongly than with surface-absorbed

processes, except in respect of the colour of the 'paper white' areas of the image. Shiny 'receiving' papers – fixed out silver gelatine papers for example – exhibit higher gloss after processing (report in the Appendix). The carbon-transfer process is noted for its ability to reproduce fine detail as the examples of imagesetter 1 and 3-pixel matrices, *Illustration 5.3.2.7* below, printed on Fabriano 5 paper evidences.



1-pixel Carbon-transfer
x20 magnification



3-pixel Carbon-transfer
x20 magnification

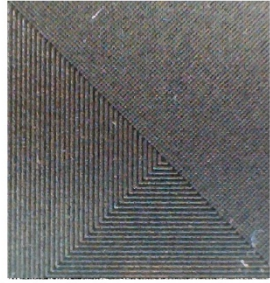


3-pixel Carbon-transfer
x400 magnification

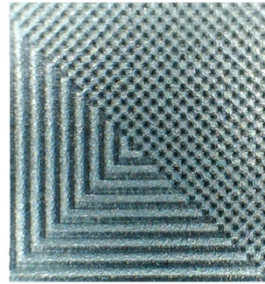
Illustration 5.3.2.7

1- & 3-pixel matrices – carbon transfer prints

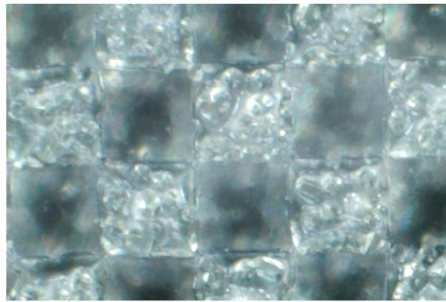
The prints exhibit higher definition and contrast than most surface-coated processes and the high acutance shown in the 400x magnification micrograph confirms carbon-transfer's reputation for resolution.



1-pixel Gravure plate
x20 magnification



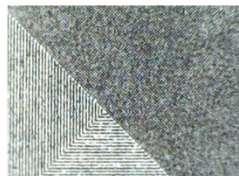
3-pixel Gravure plate
x20 magnification



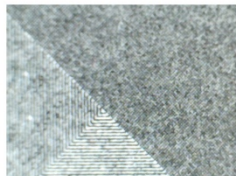
3-pixel Gravure plate
x400 magnification

Illustration 5.3.2.8

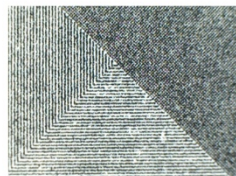
Imagesetter pixel matrices – Gravure plates



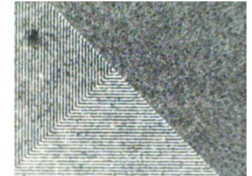
Accademia 1-pixel matrix x20
Salt printing



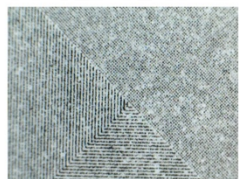
COT 320 1-pixel matrix x20
Gravure printing



Platine 1-pixel matrix x20
Gravure printing



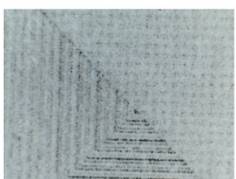
Aquarelle 1-pixel matrix x20
Gravure printing



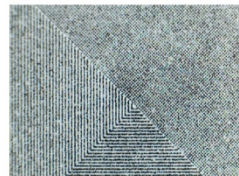
Hahnemuhler 1-pixel matrix x20
Gravureprinting



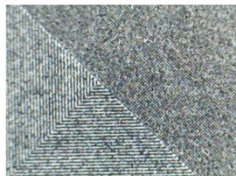
FAB. 5 1-pixel matrix x20
Gravure printing



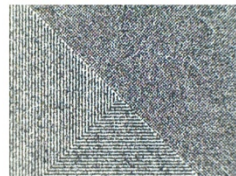
Zerkall 1-pixel matrix x20
Salt printing



Somerset 1-pixel matrix x20
Gravure printing



Heritage Rag 1-pixel matrix x20
Gravure printing



Artistico 1-pixel matrix x20
Gravure printing

Illustration 5.3.2.9

Imagesetter pixel matrices – gravure prints

Photogravure images similarly depend upon the attributes of the transfer medium – in this case copper or photopolymer plates, where the etched lines and tonal areas carry and impress ink into the receiving paper. Both copper and polymer plates carry fine detail, possibly finer than the ink-jet negative printing process can transfer. Imagesetter film 1 & 3-pixel matrices are shown as etched into a polymer plate in *Illustration 5.3.2.8* above. The three dimensional topography of the plates can be perceived in the micrographs - the 'bubble-wrap' appearance of the 400x magnification is caused by aquatint etching necessary to hold the ink in the shadow areas. Although the 'bubble-wrap' seems to stand proud of the surface, this is an illusion of the photography. These areas are sunk into the plate, it is the interleaved squares which form the flat plate surface and can be wiped clean of ink to produce the 'paper-white' areas on the print. The fibrous make-up of paper substrates affects the transfer of gravure ink influencing both the tonal qualities and resolution of the reproductions, this is shown in *Illustration 5.3.2.9*, above. The contribution of the receiving paper is evident in these micrographs, but the quality and characteristics of reproduction are also strongly affected by variables under the direct control of the practitioner namely, press roller pressure, type of blankets, type of ink and any additives, and the craft skills of wiping and plate preparation. The micrographs of the different processes and papers demonstrate that apparent image 'sharpness' is a function of tonal contrast as well as resolution.

Phase A investigations included an assessment of the tonal scale (density range) of the processes and selected papers. The results are summarised below, *Table 5.3.2.10*.

Paper	Process Density Range (log scale): $D_{min} \leftrightarrow D_{max}$					
	Cyan	Salt	Albumen	Platinum	Carbon	Gravure
Accademia	1.37	1.19	1.26	1.19	1.23	1.28
Aquarelle	1.39	1.01	1.25	1.33	1.18	1.33
Artistico	1.45	1.18	1.22	1.19	1.40	1.41
Cot 320	1.34	1.07	1.18	1.23	1.29	1.33
Fabrizio 5	1.34	0.89	1.27	1.35	1.53	1.28
Hahnemuhle	1.21	1.15	1.17	1.28	1.31	1.35
Heritage Rag	1.35	1.22	1.29	1.37	1.42	1.38
Platine	1.22	1.17	1.27	1.38	1.43	1.27
Somerset	1.43	1.15	1.18	1.33	1.29	1.39
Zerkall	1.28	1.18	1.23	1.19	1.27	1.28
<i>Process Density Range (log scale): $D_{min} \leftrightarrow D_{max}$</i>						
<i>Glossy inkjet</i>	<i>2.01</i>					
<i>Satin inkjet</i>	<i>2.49</i>					
<i>Matt inkjet</i>	<i>1.33</i>					
<i>Silver gelatine (resin)</i>	<i>2.21</i>					

Table 5.3.2.10

Density range – selected papers and processes

The tonal differentiation and print 'mottle' of the papers and processes were assessed by graduated inkjet stepwedges printed alongside the resolution targets. *Illustration 5.3.2.11*, below,

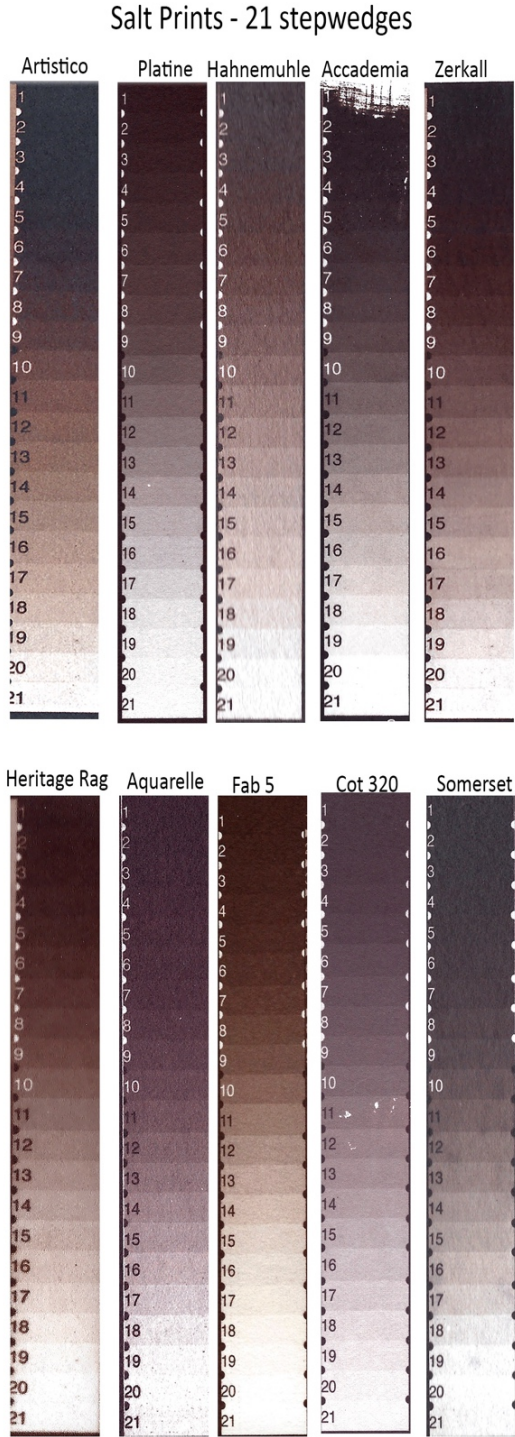


Illustration 5.3.2.11

Salt printed stepwedges

shows 21 stepwedges as Salt prints on the ten paper samples. *Illustration 5.3.2.12*, below shows the stepwedges printed by the Platinum/palladium process. These test demonstrated that all

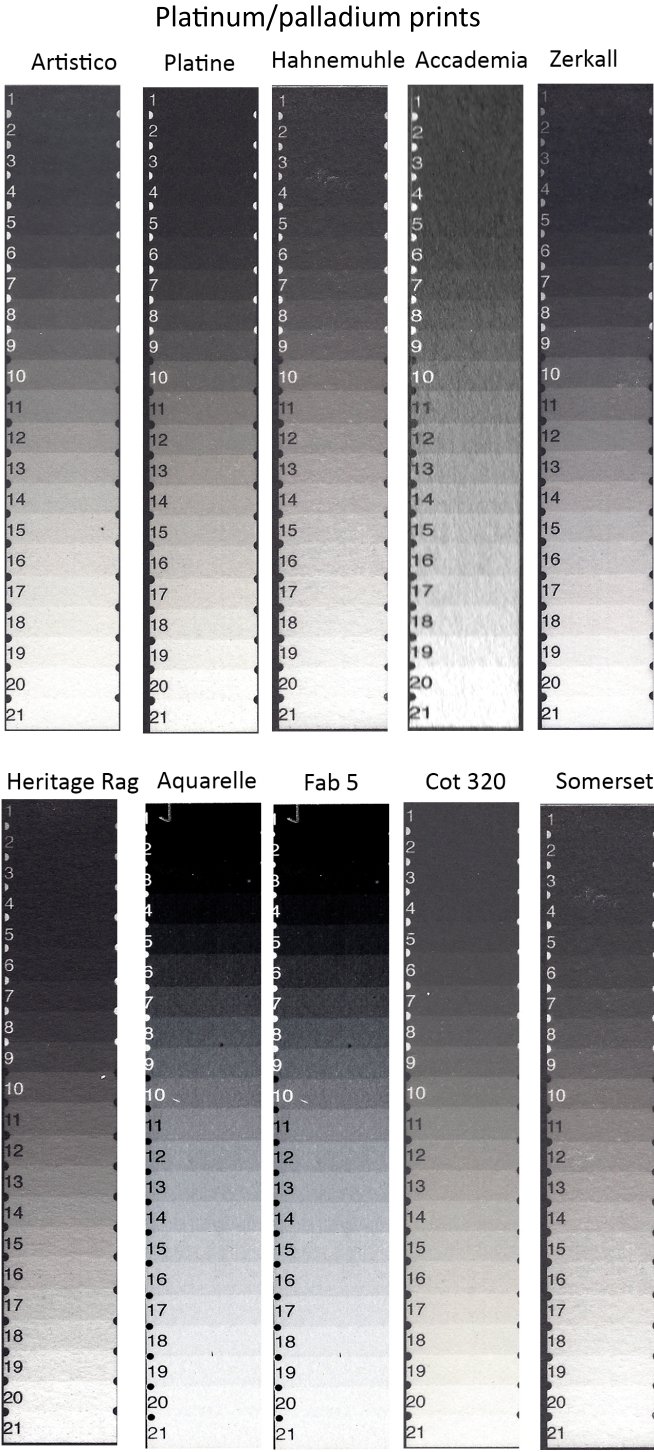


Illustration 5.3.2.12 Platinum/palladium prints

the papers could print a full-tone stepwedge. There were colour differences between the papers, however, particularly in the Salt prints, and significant variations in smoothness of tonal transition and evidence of mottle, that are not fully reproduced in the illustrations above. It is believed that the colour variations are related to the composition and *ph* balance of the papers and are not correlated with smoothness of tone. Zerkall, Platine, Heritage Rag and Artistico (platinum/palladium) provide good tonal separation and smoothness, the other papers evidenced some mottling and were less smooth. Somerset, despite its very textured and soft surface, performed well. The outcomes for the other processes are described in the Appendix to this Chapter, but the similarities of result shown above were not fully replicated and there was significant substrate variations across as well as within each process.

5.4 Phase A – Commentary

Two points stand out from this phase of the investigations. Firstly, the scale of the differences in gloss and print density between inkjet and silver gelatine papers and the paper stock used for the contact printing, which by comparison were greatly subdued in their contrast and depth of shadow areas. Secondly, considering their differences in composition and finish, the variations in outcomes for the paper samples appeared from the measurements to be relatively modest and not consistent across the processes. In some cases, the density ranges achieved from the selected papers reflect their pre-processing surface sizing and appropriateness for purpose – Somerset and Hahnemuhle are soft etching papers and could be expected to work well as gravure substrates, whilst Artistico and Aquarelle are water-colour papers designed to carry a heavy surface load without too much loss into the fibrous interior. However, variations were significant and idiosyncratic, papers of the same type did not always respond consistently, and slight differences in treatment had unanticipated outcomes. For example, the colour and

maximum density of salt prints was notably unpredictable and ‘outlier’ results not uncommon, so that a number of productions was necessary to obtain more reliable average measurements.

All ten selected papers ‘worked’ with all the processes. On the basis of the *Phase A* empirical measurements – with their inconsistencies and modest variations – it is not appropriate to attempt a rank order of substrates. Which is not to say that there are no significant differences between processes and between papers, rather that the ‘*feel*’, the ‘*haptic*’ and the ‘*physicality*’ of the different productions were not captured by the measurements employed. Salt and platinum prints, for example, exhibit similar resolution of detail, similar gloss levels, shadow and highlight tonal differentiation and not greatly dissimilar colour, but to this observer they do not exhibit the same aesthetic or ‘presence’, which is carried differently by each paper. Interestingly, the vernacular vocabulary of description offered by observers, reported in Chapter Seven, is sensitive to this, but does not provide a consistency of categorisation that captures or discriminates the aesthetic potential of these ineffable differences in print performance.

Phase B, which examines the effects of different negative colourisations and UV sources on print qualities is reported in the following Chapter Six.

Chapter Six Digital performance

'If we simplify, for the moment, the differences in printmaking techniques and the varying consistencies of printmaking inks, then its multiple, complex layering is what constitutes the particular surface of the print. It is the condensation through different layers that accounts for the materiality, even tactility of the print. Today, older technologies of print (including, ironically, screen printing) yield a tactile, 'fleshy' surface in comparison to the mean slimness of the digital print'.

Ruth Pelzer-Montada (2008: 78)

Digital performance – practice-based research issues

In earlier chapters, I consider the language of photography (Chapter Three), representations of the skin, body and person (Chapter Four) and aspects of the material characteristics of early contact-printing processes (Chapter Five). This chapter and its Appendix build on these analyses and report practical experimentation and technical or syntax adaptations developed to exploit more fully the print surface and tonal potential achievable through the use of inkjet negatives. The general limitations and advantages of digital negatives are first considered, with an account of the requirement for the use of *linearisation* techniques in order to accommodate the output capabilities of inkjet printing (sections 6.1 to 6.3). Sections 6.4 to 6.6 set out the *Phase B* research objectives for the optimising the employment of inkjet negatives by matching the choice of colour of inkjet negative to the emission spectra of UV light sources in order to enhance print definition and tonal discrimination. Section 6.7 reports the experimental findings and discussion of the *Phase B* continuation of the material investigations described in Chapter Five (supported with further detail and argument in the Appendix to this Chapter).

Photographic contact-prints require negatives of the same size as the desired final image. Digitally mastered and printed negatives offer the advantage to practitioners that the output of contemporary cameras may be used directly and inkjet negatives may be re-sized and reprinted at will. However, very careful design and control of workflow and materials is

necessary to produce inkjet negatives that match the smooth continuous-tone gradation and fine grain structure available from film negatives. In analogue negatives the image is commonly formed of microscopic distributions of silver halide molecules, whereas inkjet negatives are composed of individual squirts of pigment or dye inks absorbed within a coating on a transparent substrate. Without compensatory manipulation of the digital image, standard inkjet equipment cannot produce negatives that demonstrate, across the full tonal range, an even or linearised change in opacity to ultraviolet light. Without these preparatory adjustments, print highlights can be 'blown-out', shadow areas 'blocked-up' and tonal transitions liable to posterisation.

The computer manipulations and adjustments necessary to print linearised and smoothly gradated inkjet negatives require significant moderation of the tonal values and range of the original digital image in order to match the different UV wavelength exposures necessary for each photographic process to the idiosyncratic output of each type of inkjet printer. The question and investigation adopted for this strand of the *practice-led* research examine the characteristics of inkjet negatives in relation to the qualities of the final contact-print. The outcomes of the research establish techniques that reduce the scale of the digital manipulation necessary for the linearisation of inkjet negatives, enhancing print resolution and tonal differentiation, and determine the most effective negative colourisation in relation to the emission spectra of different sources of ultraviolet light and the wavelength responses of particular photo-sensitive coatings.

6.1 Inkjet negatives for photographic contact printing processes

Digital/analogue hybrid practice is now common amongst printmakers using nineteenth century contact-printed photographic and photomechanical processes. The main perceived advantages include ease of production of enlarged negatives – no necessity to work in total

darkness making film inter-positives – and the ability to manipulate both the original image and the negative to exploit the particular characteristics of the chemistry and qualities of each process. Where digital capture is not the preferred mode of origination, film negatives may be digitally scanned at high resolution for enlargement and processing. The quality of the final ‘hybrid prints’, in terms of resolution, tonal gradation and absence of intrusive halftone artefacts, has now reached a high standard not easily distinguishable from entirely film-based work. Film aficionados, though, claim still to detect subtle difference, much as vinyl-buffs are critical of CDs.

Inkjet negatives printed on a variety of paper substrates – including regular office paper, watercolour paper and commercial inkjet photo-papers – can be used to produce contact-print negatives. They necessitate, though, very long exposures and, as with Fox Talbot’s printing with *calotype* paper negatives, even with oiling to improve transparency some signs of the paper fibres may be evident in the final prints, which in any case are likely to show a certain softness of tone and focus. Though digital paper negatives require long exposures, they are less likely to exhibit two key and long-stranding issues almost universally experienced with inkjet printing on transparency films, namely: unevenness of tonal gradation and inadequate ink opacity. Inkjet printers and commercial inkjet papers are well able to produce a gradation ramp, from paper white (minimum density or D_{min}) to full black (maximum density or D_{max}) where the tonal changes are smooth and demonstrate a straight-line, even increase in density across the whole gamut. *Illustration 6.1.1*, below, represents such a ‘linearised’ gradation from 100% to 0% density across 21 equal steps. Printing on acetate transparencies, however, including those specifically produced for inkjet use, rarely if ever produces such accurate tonal rendition. *Illustration 6.1.2*, below, is an indication, somewhat exaggerated for effect, of the common failing of inkjet negatives on transparency substrates to print even gradations of tone from D_{min} to D_{max} . The extent of the problem of



Illustration 6.1.1 Grayscale tonal wedge on inkjet paper, showing 'linearised' print density

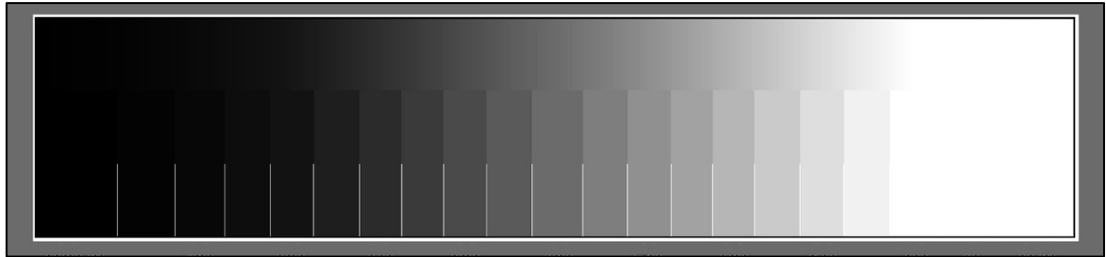


Illustration 6.1.2 Grayscale tonal wedge printed on transparency substrate, showing 'burnt-out' highlights and 'blocked' shadows.

linearisation is shown in *Figure 6.1.3*, below. The graph plots the ultraviolet transmission density (i.e. the opacity to UV light) for each of 21 steps of equally increasing digital density as printed out using an Epson 3800 on Agfa Copyjet transparency substrate, measured with X-rite 361T densitometer. Interestingly, the green ink – or rather, the combination of inks from the yellow and cyan cartridges selected by the printer to create green – is more opaque to UV light than the black inks, and yellow also has greater density at the higher steps than black. The only ink deposition that approaches a straight-line linearised output on the transparency is the blue stepwedge (actually, a printer determined blend of cyan and magenta inks), but the opacity or density is too low to be effective as a negative for many processes. Digital manipulation before printing, using adjustment procedures in software programs such as Photoshop, is therefore required to modulate the tonal fidelity of the on-screen image in order that it may produce correct linearised gradations when output from the printer. Digital processes, of course, lend themselves to such precise calibration and control procedures, but these require somewhat specialised experience and equipment to conduct.

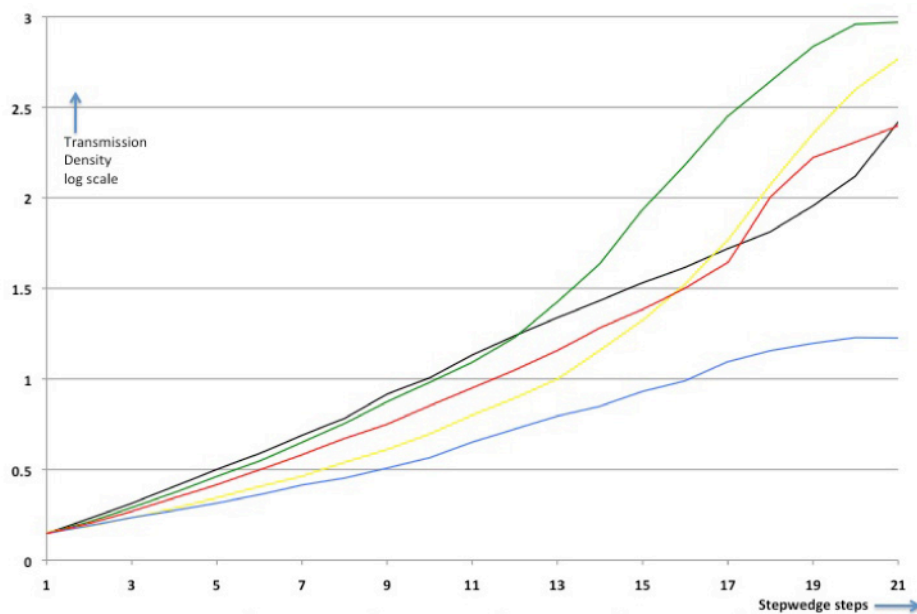


Figure 6.1.3 Ultraviolet transmission densities of digital 21 step wedges printed with green, black, yellow, red and blue inks on Agfa Copyjet substrate with Epson 3800 printer.

The facility offered by proprietary software – *Photoshop* in the case of this research – accurately to calibrate final print output against digital file input provides a significant additional benefit. Inkjet negatives can be adjusted to match the exposure and development characteristics of different types of photosensitive chemistries and coatings. The platinum process, for example, is renowned for its ability to print from negatives with an extended tonal scale, that is from negatives with a wide range of transmission densities, from very bright shadow areas to very dense highlights, which could not produce silver-gelatine prints. Whilst it is skilled work to take and prepare film negatives and to process platinum prints to avoid tonal compression and loss of detail in either the shadow or highlight areas of the print, digital calibration procedures facilitate adjustment/distortion of the tonal gradations of inkjet negatives precisely to match or to exploit the photo-sensitivity characteristics of the process.

Poor ink opacity, on film transparencies, of early inkjet dye-based inks was a major problem for printmakers in the 1990s. Whilst the inks, particularly the black inks, appeared dense when printed on paper, they often lacked sufficient density, when exposed through ultra violet light, to produce quality prints where the processes required fairly lengthy exposures, such as albumen, platinum or carbon-transfer. Later pigment-based inks demonstrated improved opacity, but many of the transparency substrates then commercially available were unable to receive and hold sufficient quantities of either dye or pigment ink without pooling on the film surface. For a period, a popular route for hybrid printmakers was to have their digital negative files screened as halftone dots and laser printed on film by *imagesetters*. Commercial imagesetting is now very difficult to source, so this option is currently rarely employed.

Over the last twenty years, the development of hybrid digital/analogue photographic printing has shown a level of enthusiastic exploration by artist-practitioners that echoes that of the innovations in the early stages in photography's history. There is little serious commercial interest, however, in developing equipment or materials save for the enlargement and printing of digital files on traditional wet-chemistry paper, Lambda and C-type processes for example, where it is felt that genuine 'photographic quality' is advantageous for 'high-end use'. In consequence, a variety of what might best be described as home-grown techniques have been developed to make use of the convenience of inkjet printing and the extraordinarily powerful capabilities for the literally pixel-by-pixel manipulation and control of digital imagery. Basically, these techniques are 'work-arounds', though successful ones, dealing with the twin issues of ink opacity and evenness of tonal gradation through various forms of digital calibration, choice of ink and transparency substrate.

Dan Burkholder (1999) was one of the first published authors in the field to advocate the use of coloured or *spectral* inkjet negatives, as he named them, for many nineteenth century contact-printing processes. Burkholder overcame the relatively poor opacity of dye-based black inkjet inks by the use of standard coloured inks that he found to be markedly less transparent to the ultraviolet exposure necessary for these processes (as indicated in *Figure 6.1.3* above). Depending on the particular process chemistry and the make of printer ink-set, he showed that red, green or blue inks had higher transmission opacity to the relevant UV wavelengths, or rather, from what the inkjet printer laid down as red, green or blue inks from the (then) more restricted number of cartridges installed – usually only magenta, cyan, yellow and black. Burkholder also published calibration techniques, using densitometers or scanners, to effect uniformity and evenness of tonal gradation in the final print by computer manipulations to distort the digital image in prior anticipation, as it were, of shortcomings of the inkjet lay-down of ink and the characteristics of the wet chemistry processes. Whilst there have been no radical alternatives proposed since then to the fundamentals of Burkholder's approach, there have been developments and refinements of methods (Harmon, *n.d.*; Koch-Schulte, 2007; Nelson, *n.d.*; Reeder, 2007). These accompanied a significant expansion of the choice and availability of inks and the range of transparency substrates.

Leaving the paper-substrate variables aside, considered earlier in Chapter Five, key print attributes – reflectance densities, tonal range, shadow and highlight detail, acutance, granularity and colour – are affected by a number of other significant factors, including:

- length of exposure,
- wavelength of the exposing light,
- colour, tonal gradation, definition and transmission density of the negative,
- properties of the negative and print substrates, and
- chemicals for developing/processing and treatments.

Maximum reflective density and tonal gradation of prints, amongst other visual attributes, are strongly affected not only by the colourisation of the negative but also by its interaction with the type and wavelength of UV light sources. There are two major types of difficulties experienced in managing the density range and colourisation of negatives. Firstly, ink sets are commercial products, their formulations vary markedly and are rarely revealed. In consequence, their contribution to digital negative printing under UV light is known only by empirical testing and is difficult to derive from principles of chemical and optical operation (King, *n.d.*). The performance of inkjet printers will vary significantly according to the qualities and nature of the inks installed, due, for instance, to their variable viscosity, pigment load or solvent base. Secondly, the operation of inkjet printing necessitates the collaboration at least three different proprietary software programs – the computer operating system, the image editing program and the inkjet printer driver – each with its own colour management

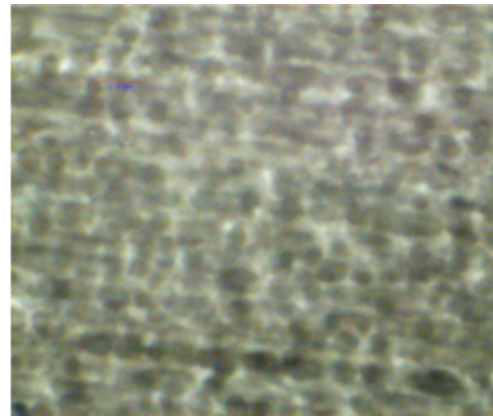


Illustration 6.1.4
Epson 3800 driver – black ink at 50%

Micrographs x400
QTR driver – black ink at 50%

structure and organisation eager to contribute to the translation of on-screen RGB colour to the printer's CMYK operations.

Illustration 6.1.4, above, shows micrographs (400x magnification) of two **black** patches, one printed by the Epson 3800 driver and the other by a proprietary driver (*QuadTone RIP*) that

controls ink cartridges individually. The Epson driver appears hardly to employ any actual black ink, preferring to compose the colour from a mixture of all other cartridges, the drops of which all have individual differential opacities to UV light, whilst the QTR software employs just the one full-black cartridge. The halftone dither or stochastic patterns are radically different too, with the QTR lay-down seemingly more prone to striations or micro-banding.

6.2 Linearisation of printer output and process response

Practising contact-printers using inkjet digital negatives select colour and compensatory linearisation on experimental determination. This initial adjustment is essential to ensure the full articulation of tonal differentiation in the negative print-out. Without linearisation it is very likely that the print will demonstrate poor separation in the highlight or shadow areas, or posterisation where tonal distinction is step-like rather than smooth continuously gradated transition. *Figure 6.2.1* below, shows the measured UV transmission densities of five colourised stepwedges printed on *Agfa Copyjet* transparency film after the application of a compensatory adjustment using the image-editing software *Photoshop*. These stepwedges, in contrast with those in *Figure 6.1.3* above, demonstrate a more linear or straight-line increase in UV opacity as the density of ink deposition increases.¹

Frequently, a second order *calibration* adjustment is necessary to accommodate the particular chemical reactions of each type of photosensitive coating as activated by the emissions spectra of the ultraviolet light source. There are few contact-printing processes that respond in a linear manner to equal increases in UV exposure, though carbon-transfer is one of the exceptions. Many photosensitive coatings, for instance, show ‘reciprocity failure’

¹ In the case of the results reported here, the reflectance densities of the print have been determined using a X-rite 810 densitometer and the UV transmission densities of the negative by a X-rite 361T whose measurements are grouped around UV light at 380nm.

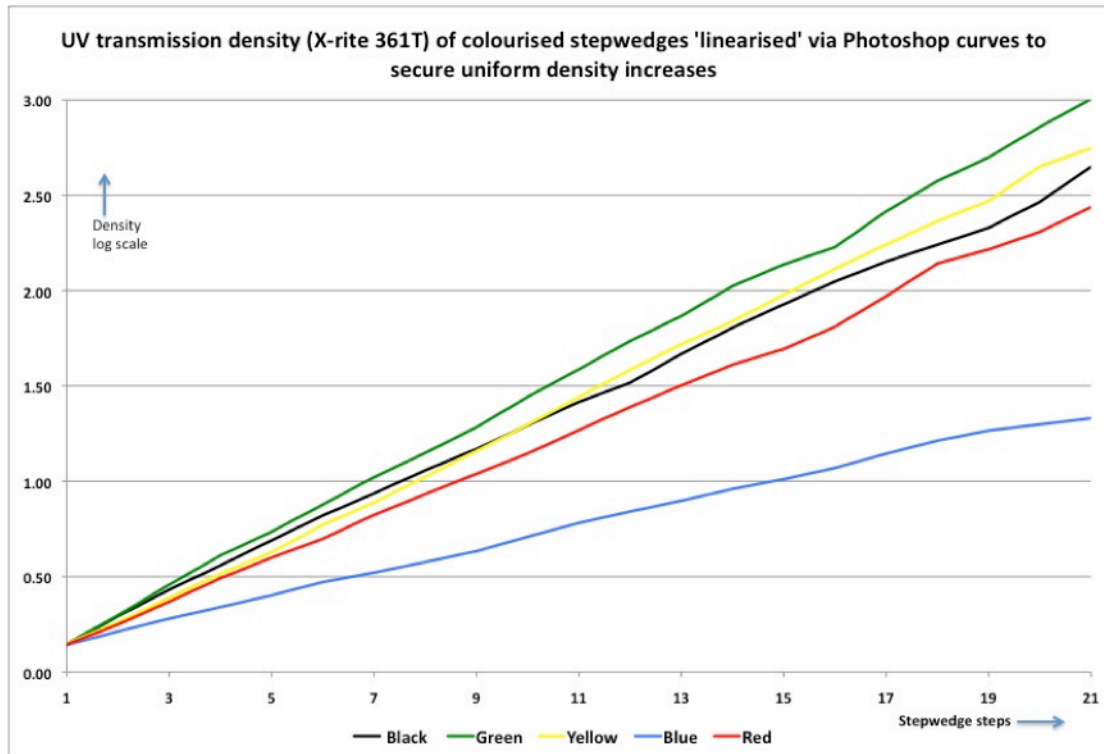


Figure 6.2.1 Ultraviolet transmission densities of digital 21 step wedges printed, after linearisation, with green, black, yellow, red and blue inks on Agfa Copyjet substrate with Epson 3800 printer.

where extended exposure has proportionately less effect – so that it may become difficult to produced full tonal differentiation in both the shadow and highlight areas of the print.

Accordingly, it is common practice to interrogate the relationship of the transmission density of the negative stepwedge with the reflectance density of a gradated stepwedge produced as a final print. This allows the calculation of a second order *calibration* adjustment of the digital image, which can then be applied to future printings in order to ensure that the tonal gradation of the on-screen image is accurately and reliably reproduced in the print.

The capability of software image-manipulation programs to colourise the negative and to adjust its distribution of tones – for shadow, highlight and mid-tone areas – to match, and thus exploit, both the sensitivities of the chemistry of each particular contact printing process and the emission characteristics of UV light sources is a major benefit. This research shows

how with careful matching of negative colour to the emission spectrum of the UV source, exposure of the original photograph does not have to be determined with any single print production process in mind and the potential limitations of 'short-scale' photo-chemistries can be minimised. To explain: platinum is commonly said to have a 'long tonal scale', contrary to what is commonly inferred, this does not mean that there is a greater range of tone densities in the final print, just that the platinum process can cope with a film-negative with an extended range of tonal densities. This is claimed to account for finer, more sensitive tonal differentiation in the platinum print, because the process can support a more tonally differentiated film-negative. By comparison, the cyanotype process can cope only with a negative of a more restricted density range. When printed with longer density range negatives, such 'short-scale' processes lose either significant shadow or highlight details in the print, depending on the exposure. Why the platinum/palladium and carbon-transfer processes, for example, accommodates a longer scale of film negative is not clear. The most common explanation is that the process is 'self-masking', i.e. the chemical changes in the shadow tones on the exposing print act to attenuate the transmission of the UV light thus preventing the over-exposure of the shadow tones in the print and allowing, as the exposure is prolonged, the denser negative areas to work their magic and produce delicately differentiated highlight tones. However, whilst the early darkening of the shadow print areas in *printing-out* processes such as salt (long-scale) is visible by inspection, it can also be seen in 'short-scale' cyanotype, and it is not visibly evident in *developing-out* processes such as platinum or 'long scale' tanning processes such as carbon transfer. In these cases, inspection of both partial and complete exposure, prior to development, shows only modest darkening visible – leaving the self-masking argument still open.

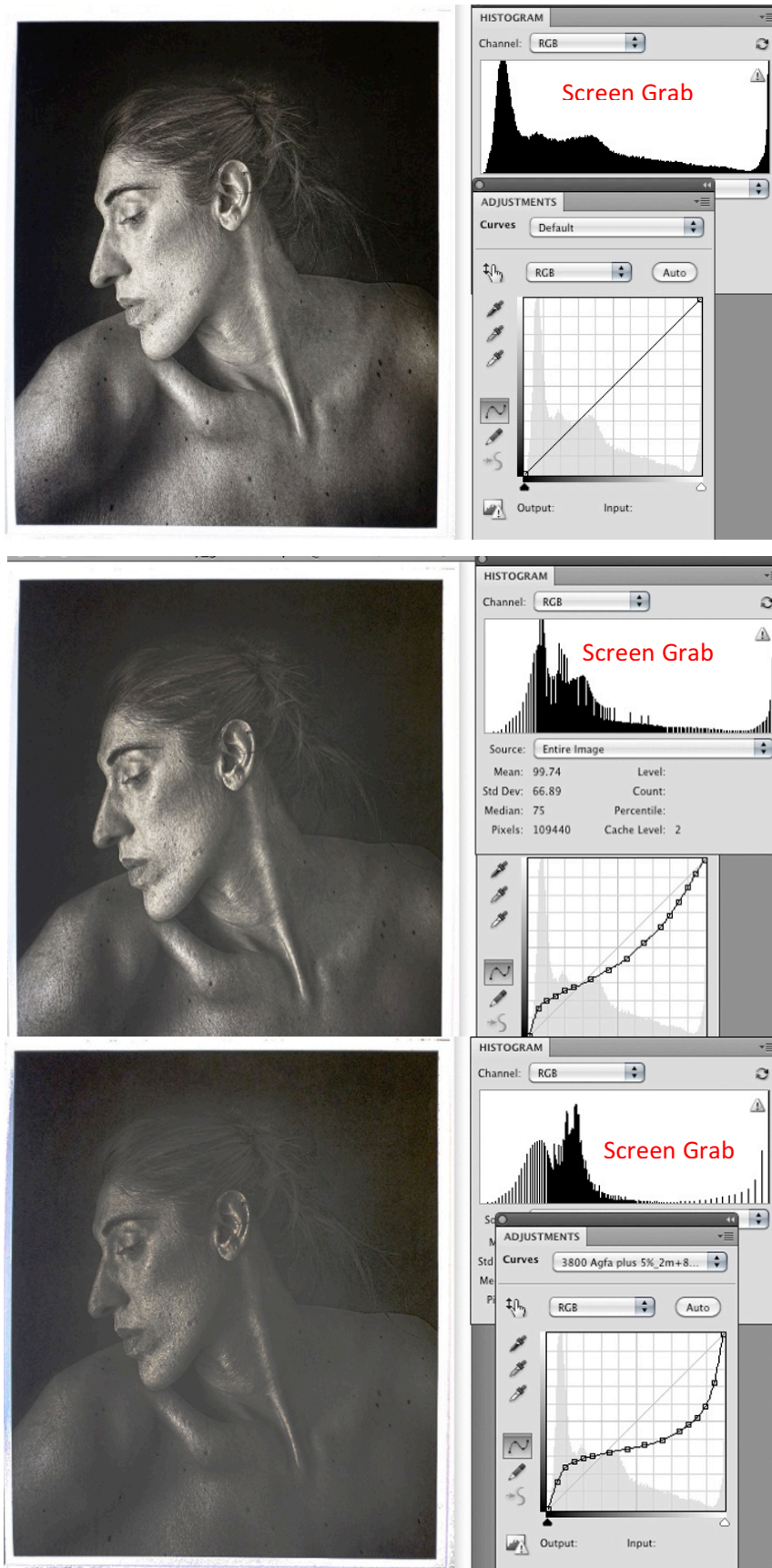
The project's experimental results are consonant with these differential effects being, in part, a wavelength related phenomenon and that short-scale processes may be printed optimally

with the correctly chosen UV wavelength matched with the correctly selected UV blocking capacity of the coloured negative. It is likely that long-scale processes are differentially photosensitive to UV emission wavelengths in a manner that 'shorter-scale' processes are not. Turner *et al.* (2014) provide evidential support, but waveband by-pass filters are required to establish this proposition and these expensive resources have not been available. My practical experience (reported below) indicates that by exposing short-range processes to selected choice of light source and colour of inkjet negative, access to the UV wavelengths to which the processes are sensitive may be optimised. In consequence, as *Illustration 6.2.2* below indicates, treatment of the original-capture digital image file to articulate and print the digital negative is less extreme in the compression of image tones required to match the chemistry of the process.

This reduction of tonal compression in turn helps to ameliorate the by-products (digital artefacts, posterisation) of image manipulation software and enhances the tonal differentiation and smoothness of gradation exhibited by the final contact print. *Illustration 6.2.2*, below, shows three 'screen grabs' from Photoshop software. 'Screen Grab A' shows an image ready for adjustment prior to printing as an inkjet negative. The histogram, top-right, shows the number of pixels recorded by Photoshop for each of its 255 tonal levels and it presents an image with a good range of tones from darkest to lightest. The adjustment layer, immediately below the histogram, shows a straight diagonal line indicating that each density 'output' value remains the same as its density 'input' value. 'Screen Grab B', middle image, shows the application of a modest adjustment of output values, likely to be effective in producing a linearised and calibrated negative for, say, carbon-transfer printing. Modest though the adjustment is, the histogram illustrates the effects on the distribution of tone. There are gaps at some tonal values which will not print out on the negative and the tones are compressed.

Illustration 6.2.2

'Screen grabs' showing application of adjustment curves



'Screen Grab C', bottom image, shows the application of a major adjustment of output printing values, for a photopolymer-gravure inkjet transparency. The histogram shows the marked effects on the distribution of tones, with significant gaps and compression, potentially leading to 'posterisation' and jumps rather than smooth transitions of tone in the final print.

6.3 Optimising the employment of inkjet negatives – research issues and objectives

Techniques for the linearisation and colourisation of inkjet output have been established (Burkholder, 1999; Koch-Schulte, 2007; Nelson, *n.d.*; Reeder, 2006) and the use of digital origination and manipulation for the production of inkjet negatives for use with early contact-printing processes has been widely adopted. The relationships, however, between the opacity of different inks and the emissions spectra of different UV sources appear poorly documented, and the implications for the quality enhancement of inkjet negatives not fully examined.

There are several reasons why these relationships are of operational significance. Firstly, inkjet negatives of whatever colour are produced of fine superimposed droplets of combinations of inks with different pigment composition, each with its own specific range of opacities to the UV spectrum (*Illustration 6.1.4*, above, refers). Most early contact-printing processes are responsive to a spread of UV wavelengths after the manner of a typical bell-curve. The practical range of sensitivity is usually between 350nm and 410nm (contact printing-frame glass absorbs much UV below 350nm) though some, cyanotypes for example, have some sensitivity to low wavelength visible light. At any and each point of tonal opacity on the negative, the blocking pigmentation of the squirted droplets will contain differentially opaque combinations of ink (again, see *Illustration 6.1.4*, above) that must result in varying degrees of mottling or graininess/granulation in the print and inhibit or enhance tonal

discrimination and print contrast. Whether these effects are noticeable or significant is a matter of experimental determination. Secondly, the various ink pigment combinations will be differentially transparent to the specific emission wavebands of different UV sources, again with mottling or tonal differentiation effects potentially more or less visible on the print.

The Appendix to this Chapter reports in detail on the emission spectra of different UV sources and the opacities of inkjet printer inks (Epson K3 Ultrachrome) across the UV wavelengths, and relates these to the reflectance densities of prints produced by different contact-printing processes (Sections A6.2 and A6.3). The use of matrices of different colour swatches (*Figures A6.3.2 and A6.3.6*) to evidence the, occasionally anomalous, relationships between ink transmission density and final print reflectance density is described.

The objective of this aspect of the practice-led research, with the aim of enhancing control of print quality, is to explore aspects of the tripartite interplay between the photo-sensitivities of the chemistry of the print coatings, the ink-droplet opacities of the negative and the wavelength energies of UV light sources. It is hypothesised that tonal differentiation and resolution may be optimised by ‘matching’ UV emissions spectrum, negative colourisation and process chemistry.

6.4 Quantitative description – inkjet negatives and UV sources

The experimental protocols for *Phase A*, reported in Chapter Five, provided for the description of the surface characteristics and reflectance of selected paper substrates and printing processes. The second phase of quantitative descriptions (*Phase B*), reported below, examined the print reflectance densities, image contrast, tonal discrimination and detail resolution achieved with selected contact-printing processes using various colourisations of inkjet negatives and selected UV illumination sources. Of the sample of papers selected for

initial description (*Phase A*), two papers of contrasting types – ‘*Arches Platine*’ and ‘*Fabriano Artistico*’ – were taken forward for use with these more extensive investigations (*Phase B*). *Platine* is unbuffered and is suitable for siderotype (iron sensitised) processes that work best on slightly acid media. *Artistico* is calendered, hot pressed, strongly surface sized and buffered. Compared, before print processing, with *Platine*, it has a bright, hard, smooth almost texture free surface, but requires washing in a dilute acid bath to remove the alkaline additives before it can be used for carbon or platinum printing.

6.4.1 *Phase B* – Protocol

The aim of this strand of the practice-led research was to minimise the potential loss of tonal differentiation and image detail through digital artefacts, posterisation and lack of digital information arising from the computer manipulations of the original image files necessary to secure linearization and calibration of the inkjet negative. The objective of this *Phase B* was to examine the relationships between negative colourisation and UV source in respect of their influence on print reflectance densities, image contrast, tonal discrimination and detail of resolution in order to identify printing combination that optimised print quality and authorial control. Six contact-printing processes were selected: cyanotype, salt and albumen, platinum/palladium, carbon-transfer and photogravure (*Toyobo Printight* KM73 polymer plate). These processes were used to print sections of the ISO 12233 resolution target, plus ‘*pixel matrices*’ and various analogue film and digital/inkjet gradation stepwedges, with three different UV light sources – an LED array, a fluorescent tube array and a metal halide bulb. A representation of the breadths of the UV emissions spectra of the three sources is shown below, *Figure 6.4.1.1*. A representation of the ‘resolution target’ is shown below (as a positive) in *Figure 6.4.1.2*. This ‘resolution target’ included extracts from ISO 12233 and the 1, 2, 3 & 4-pixel resolution matrices (*Figure 6.4.1.3*, below), all printed by imagesetter from

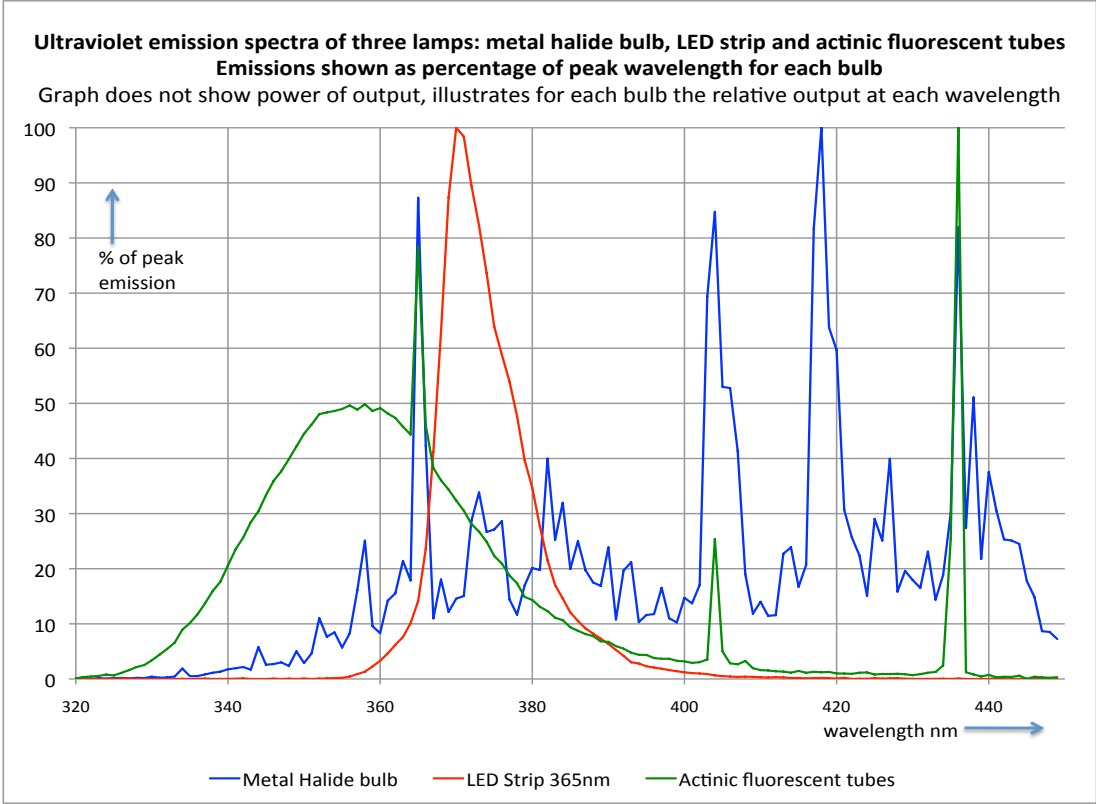


Figure 6.4.1.1

UV emission spectra of three lamps

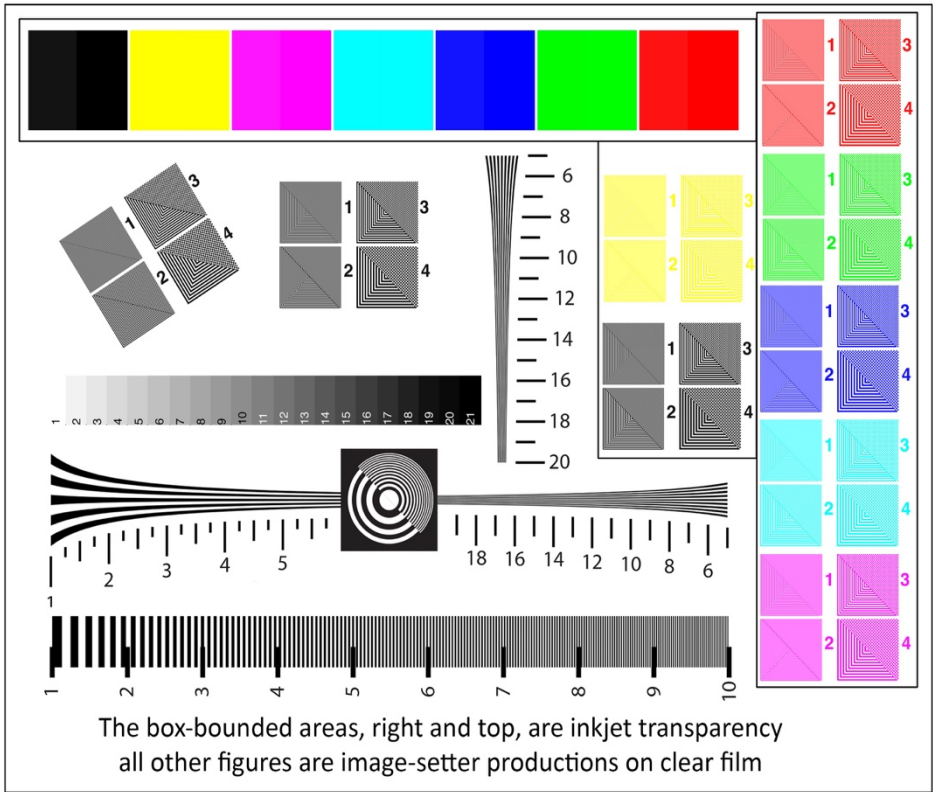


Illustration 6.4.1.2

Phase 2: representation of test targets

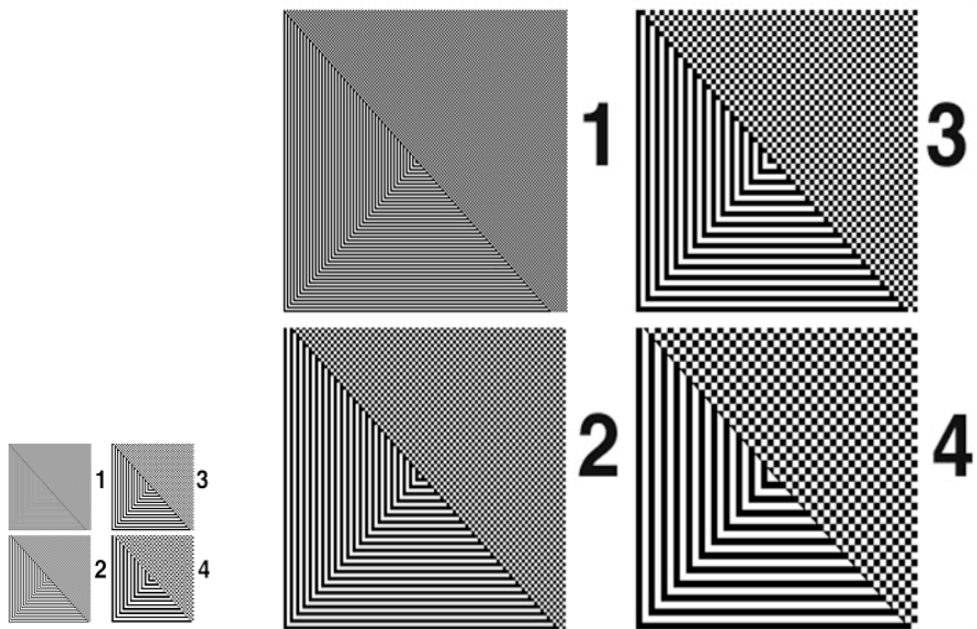


Illustration 6.4.1.3

Resolution Test Pixel-Matrices

The matrices grids are formed at 1, 2, 3, & 4 pixels dimensions (at 300ppi) and used to determine the resolution capabilities of inkjet negatives and contact-prints. The left-hand matrix is actual size, the right-hand one is enlarged to better illustrate its formation. *Matrices courtesy of 'Precision Digital Negatives' (Nelson, n.d.).*

vector files as pure black or transparent and differently coloured pixel-matrices and solid blocks of colour. These combinations, building on the *Phase A* descriptions in Chapter Five, provided comparisons of tonal gradation and print resolution across different processes and different UV sources.

The effects of the colourisation of negatives was assessed using the Colour Matrix #3, *Figure 6.4.1.4* below, adapted from those reported in the Appendix to this Chapter (Section A6.3) to allow more sensitive discrimination between different colour Hues and Saturations in the red, green and blue ranges, and excluding Hues that were too transparent to UV to be suitable as negatives. The results of the Colour Matrix tests allowed evaluation both of the scale of *linearisation* and *calibration* necessary for each colour to be used for final negative and print production and the quality of its reproduction in terms of evenness and mottle.

Colour matrix - selected colours

Hue, Saturation and Brightness colour specifications

Colour swatches at 100% Brightness with varying Saturation (columns) and Hues (rows)

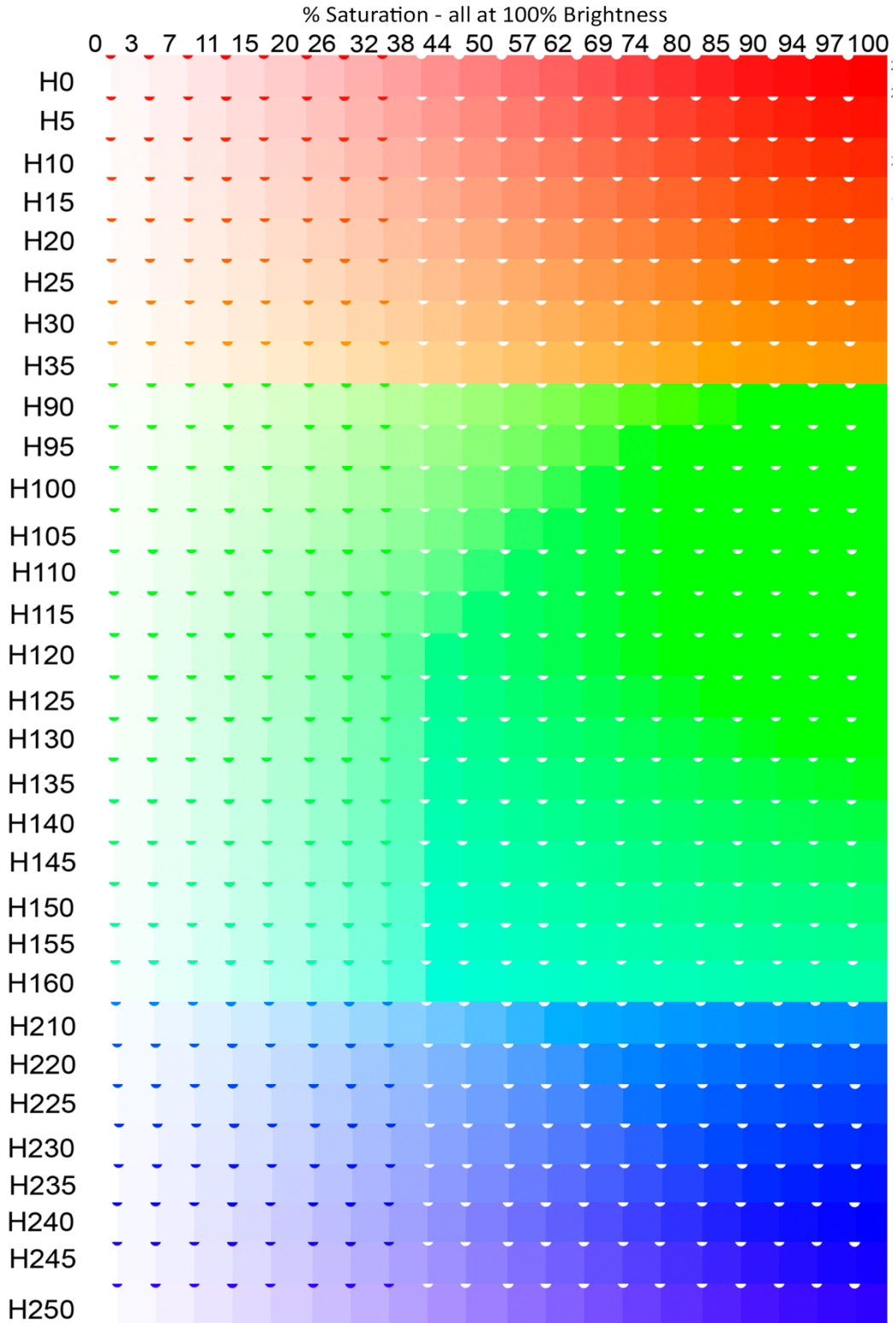


Illustration 6.4.1.4

Colour Matrix #3

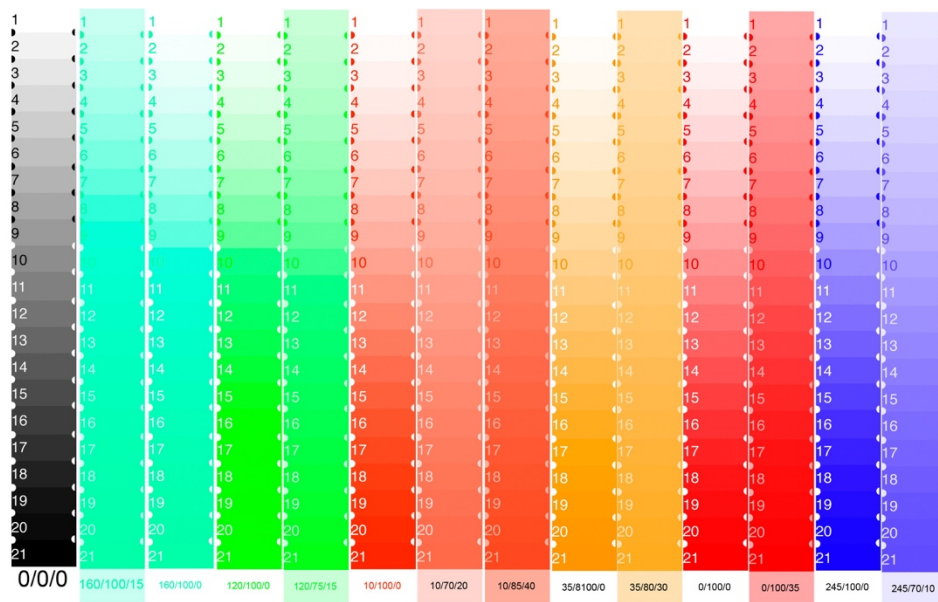


Illustration 6.4.1.5

Examples of inkjet coloured stepwedges

Examples of inkjet coloured stepwedges thus determined and produced for testing are shown in *Figure 6.4.1.5*, above. These digitally produced inkjet printed stepwedges provided for control of colourisation and, through densitometer measurement of the reflectance densities of each patch on the print, allowed for evaluation of the tonal differentiations achieved by the different negative colourisations and UV sources. The inkjet negatives for *Phase B* were printed on Pictorico TPF-100 transparency film using an Epson 3800 with K3 Ultrachrome inks at 2880x1444 dpi. Production of the prints from these negatives followed standardised procedures (outlined in the Appendix to Chapter Five). The exposures were calculated to achieve maximum print density without over-exposure. This required different exposure times for each of the three different UV sources and for each process in order to secure, in every case, the desired D_{max} or maximum reflectance density. The photo-sensitive coatings were applied by the glass-rod draw-down method, using a standard 1ml per 250 square centimetres. Print development, where appropriate, and washing and drying followed set timings and procedures. Density measurements were obtained using calibrated

equipment: an X-rite 810 densitometer for print reflectance and an X-rite 361T for the UV transmission densities of the inkjet negatives.

6.4.2 *Phase B* – findings

The findings comparing the different UV light sources and colourisations are presented and discussed in two sections: firstly, evaluations of imagesetter printed resolution tests by UV source, negative colourisation and printing process; and, secondly, evaluations of negative colourisation for linearisation and calibration, by UV source and printing process. Two sample paper stocks were included in the tests to check whether the substrate effects significantly moderated the negative colourisation and UV source effects. In practice there were no consistent differences – whilst the papers maintained their different appearances, and on occasion gave idiosyncratic results, overall they responded similarly to the UV and colourisation variables. Accordingly, the paper stock is not presented as a significant causal factor in this report of *Phase B* results. Further information on this and other findings is included in the Appendix to this chapter, but in summary the Phase results are as follows.

Negative and print resolution

The resolution of the inkjet negatives was initially examined under microscope before use for printing. The 1- and 2-pixel matrices were printed on Pictorico transparency using an Epson 3800 (K3 Ultrachrome Pk inkset) and compared with an imagesetter film reproduction. *Illustration 6.4.2.1*, below, shows five coloured 2-pixel matrices, at 20x magnification, and the imagesetter film transparency holds better detail and superior resolution. All of the inkjet matrices evidence bleeding from the lines, their supposedly clear background lines hold light colourings of various inks. The finer detail of the 1-pixel matrix (*Illustration 6.4.2.2*, below) clearly challenged the inkjet printer which introduced artefacts and could not fully reproduce the lines and squares. At 400x magnification, shown in *Illustration 6.4.2.3* below ,

2-pixel matrices inkjet printed on Pictorico transparency
with imagesetter film comparator
20x magnification

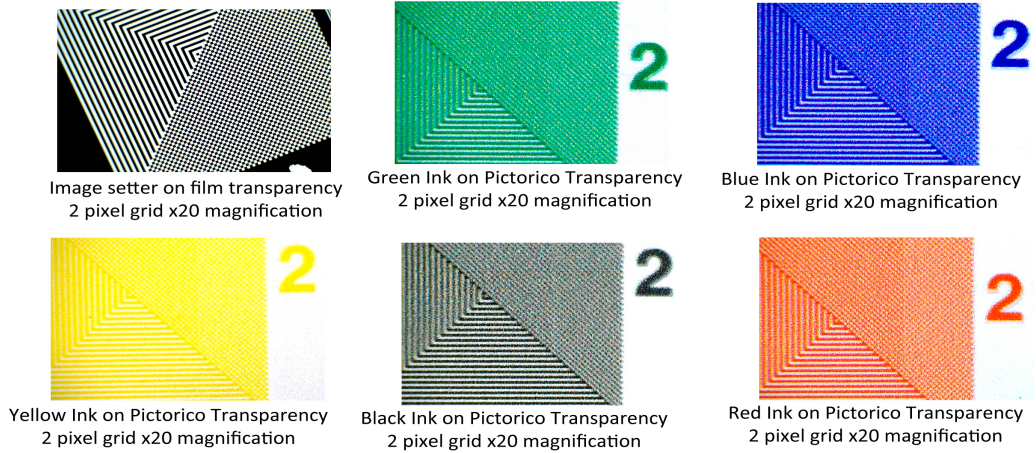


Illustration 6.4.2.1

Micrographs of 2-pixel matrices x20 magnification
Imagesetter film and inkjet printed on Pictorico transparency

1-pixel matrices inkjet printed on Pictorico transparency
with imagesetter film comparator
20x magnification

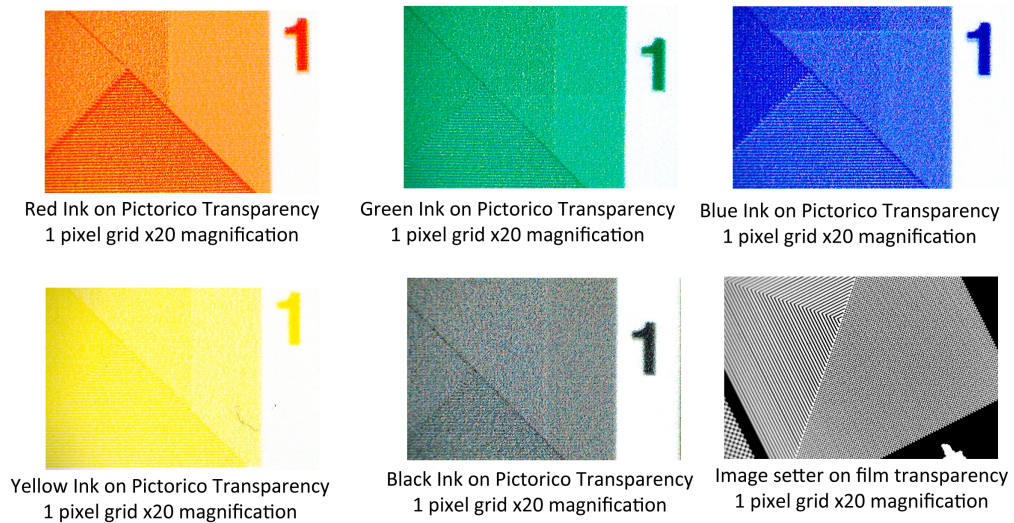
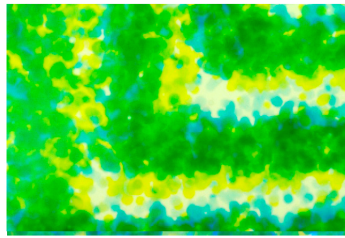


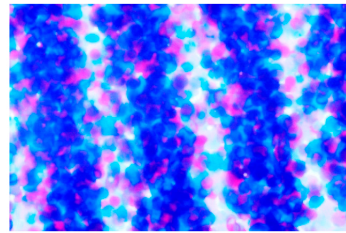
Illustration 6.4.2.2

Micrographs of 1-pixel matrices x20 magnification
Imagesetter film and inkjet printed on Pictorico transparency

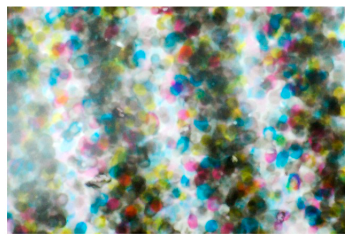
2-pixel matrices inkjet printed on Pictorico transparency
with imagesetter film comparator
400x magnification



Green Ink on Pictorico Transparency
2 pixel grid x400 magnification



Blue Ink on Pictorico Transparency
2 pixel grid x400 magnification



Black Ink on Pictorico Transparency
2 pixel grid x400 magnification

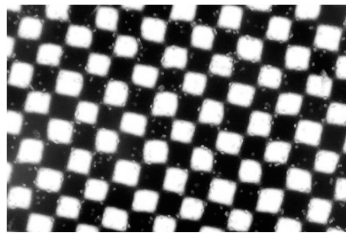


Image setter on film transparency
1 pixel grid x400 magnification

Illustration 6.4.2.3 Micrographs of 2-pixel matrices 400x magnification
Imagesetter film and inkjet printed on

the articulation of the imagesetter film was precise, but the inkjet matrices presented kaleidoscopes of ink-drops with very uncertain line boundaries and ambiguous colourations. Various software settings and different transparencies for the inkjet printer were tried, but with no significant improvement on the results illustrated above. Inspection indicated that yellow ink produced the best defined resolution of the 2-pixel matrix, followed by green, red, blue and black. The inkjet printer did not produce a 1-pixel matrix without the introduction of some artefact, frequently laying down additional vertical lines. The production of the black coloured matrix through the additional contribution of most of the other ink cartridges accounts for its relatively poor performance.

The next stage of the investigations compared inkjet and imagesetter pixel matrices printed through different contact processes using three UV sources. *Illustration 6.5.2.4*, below,

Cyanotype prints of 2-pixel matrices on Platine paper exposed by three UV sources
 Imagesetter and coloured inkjet negatives

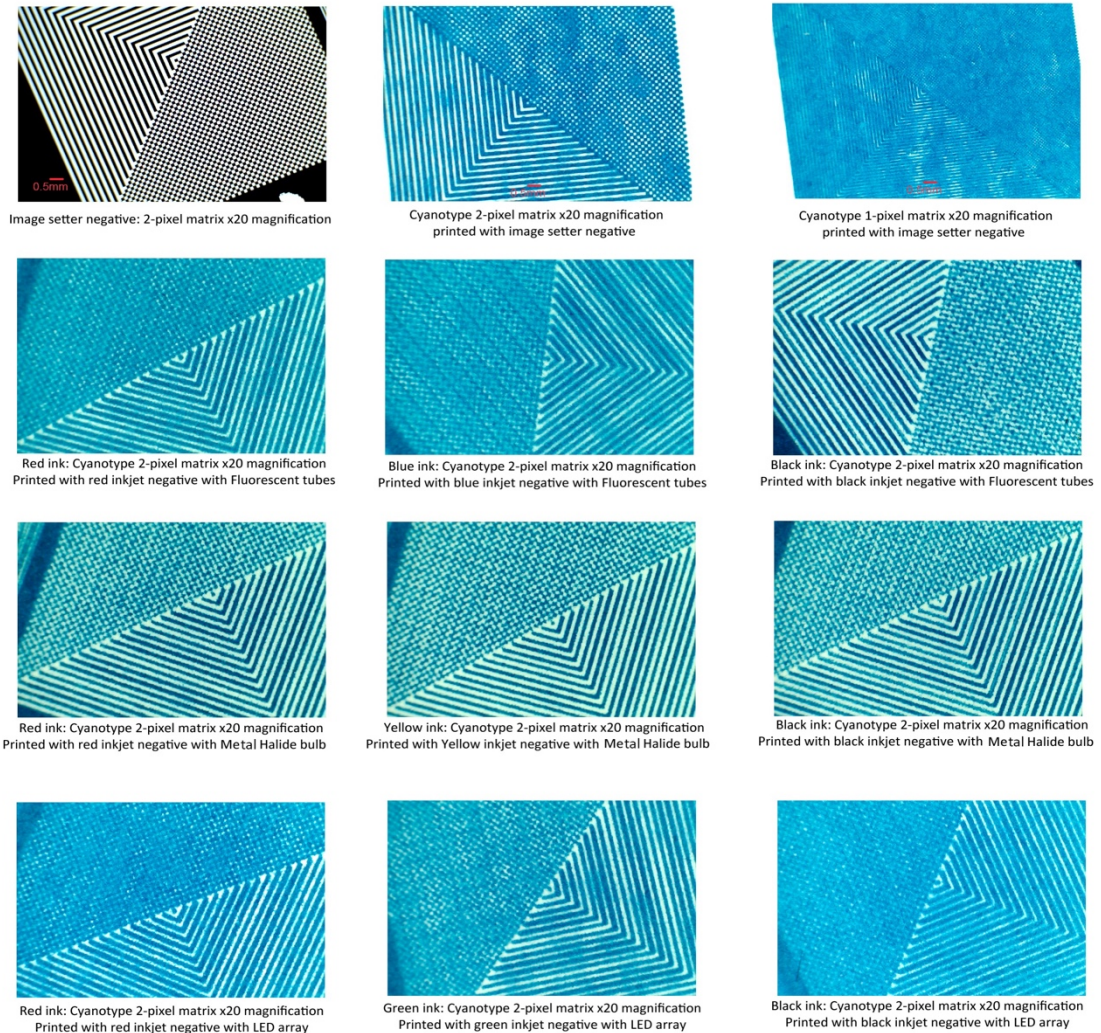
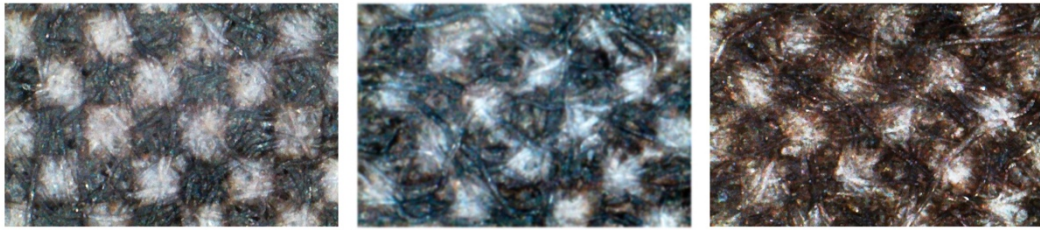


Illustration 6.4.2.4 2-pixel matrix printed by Cyanotype process on Platine three UV sources and selected negative colourisation

shows micrographs of cyanotype prints. Imagesetter negatives produced the most clearly defined 2-pixel prints and their 1-pixel matrix was partially readable. Of the inkjet negatives, yellow inks provided the best defined prints under all three UV sources, though black ink worked well with fluorescent tubes and metal halide bulbs and offered higher apparent contrast. Except under the tubes, no prints could be made with blue-ink negatives as they were too transparent to LED and metal halide sources. The metal halide bulb provided a 'single point' UV source, the fluorescent tubes and LED matrix gave diffuse illuminations and

Salt prints made with imagesetter 2-pixel negatives x400 magnification



Metal Halide bulb

LED

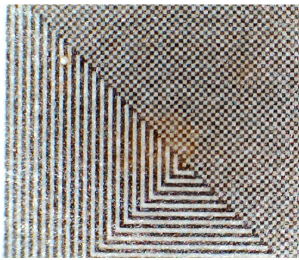
Fluorescent tubes

Illustration 6.4.2.5

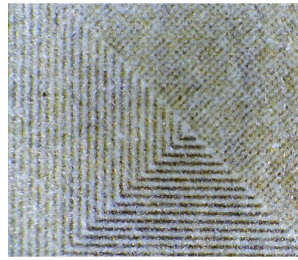
2-pixel matrix printed by Salt process on Platine x400
3 UV sources exposure of imagesetter film negative

would be expected to produce prints 'less sharp' than the metal halide. In general, this proved to be correct, but the fluorescent tubes performed equally well for carbon. The micrographs at 400x magnification, shown in *Illustration 6.4.2.5* above, evidence the differences in resolution on salt prints articulated by the three UV light sources and the 'sharper' squares produced by the metal halide bulb. A further example of the difference

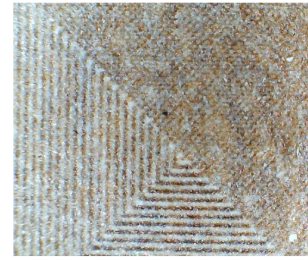
Artistic paper - Fluorescent Tubes exposure



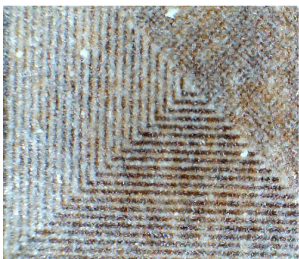
Albumen - Tubes exposure
Imagesetter 2-pixel matrix



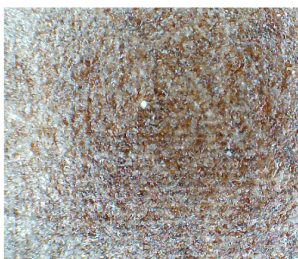
Albumen - Tubes exposure
Green ink 2-pixel matrix



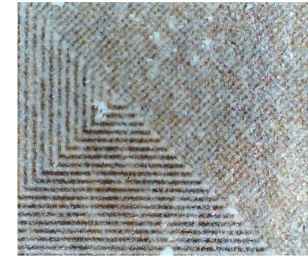
Albumen - Tubes exposure
Black ink 2-pixel matrix



Albumen - Tubes exposure
Yellow ink 2-pixel matrix



Albumen - Tubes exposure
Cyan ink 2-pixel matrix



Albumen - Tubes exposure
Red ink 2-pixel matrix

Illustration 6.4.2.6

2-pixel matrix printed by Albumen process on Artistic
Fluorescent tubes exposure of selected negative

the colour of the negative's ink makes is shown, above, in *Illustration 6.4.2.6*, where cyan failed completely and, in comparison, yellow colourisation again performed well.

Tonal differentiation

If it were just a question of straight lines and full black, then imagesetter production of negatives would be the preferred route. However, imagesetters – where they are still to be found in use – can only simulate intermediate bit-map tones through the use of solid dots of different dimensions and frequency. Their approximation of continuous and gradated tone can be problematic. In practice, inkjet printed negatives offer better tonal differentiation than imagesetter film negatives. The colour matrix #3 (*Figure 6.4.1.4*, above) was employed for two ends: to test the potential of colourisations for tonal differentiation; and to identify those colours that necessitated the smallest amount of image degradation during 'linearisation' and 'calibration'.

Illustration 6.4.2.7, below, provides an example of the information derived from the tests. The illustration is compiled from sections of platinum/palladium prints of the colour matrix made under three UV sources. Each row on 'colour matrix #3' transparency articulates a gradation of a particular colour Hue from 0% to 100% Saturation, all at 100% brightness – that is, from no colour tone at 0% saturation (clear transparency) through to full colour saturation at 100%. In the prints, the low percentages of saturation on the left hand side of the negative allow the UV to penetrate and expose the chemistry to black; on the right hand side the higher opacity of the greater saturation prevents the exposure and the print remains white or less toned. Each Hue row is identified by its number in degrees from 0° (red) around to 360° (red again), via yellow (60°), green (120°) and blue (240°). The red dots on the *illustration* mark the tonal range achieved on each Hue row, from (left to right) maximum black (D_{max}) to minimum density (D_{min}). The middle dot identifies the point of mid-grey,

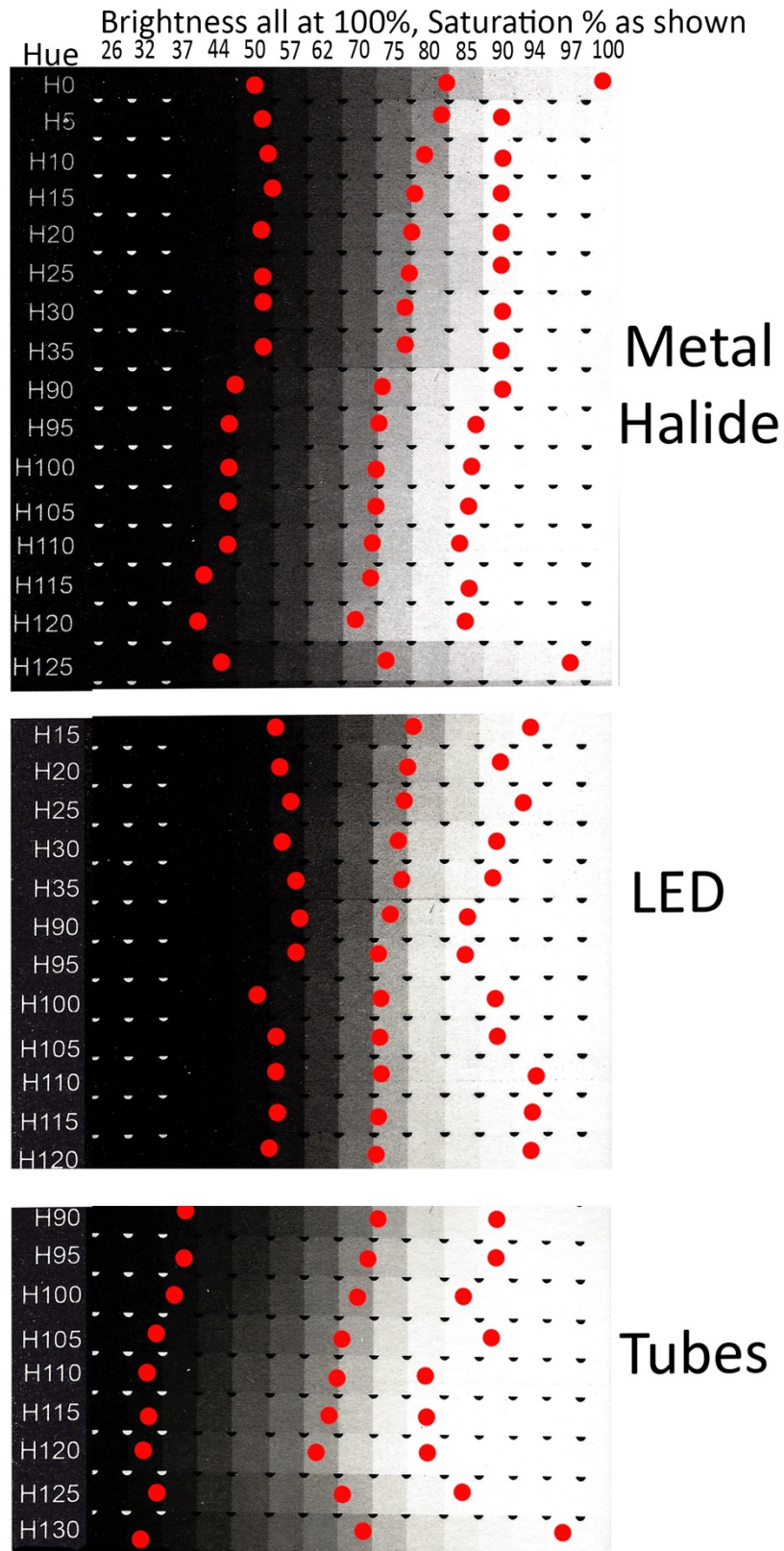


Illustration 6.4.2.7

Platinum/palladium prints of Colour Matrix #3
Selected Hue rows, by UV source

though it rarely falls mid-way between the two end points. All of the Hue colour rows shown are able to produce a full tonal range from D_{max} to D_{min} – those that could not have been omitted from this *Illustration*. Any and all of the Hues shown could be used successfully to colourise negatives, though some demonstrate additional advantages. The longer the range of Saturations between D_{max} and minimum density D_{min} , the less will be the compression of tones in the originating digital file required to secure linearisation and calibration; the shorter the gap between D_{max} and D_{min} , the greater will be the manipulation of the image file in order to secure detail in the print highlights and shadow areas. Whilst there are responses common across the three UV sources, differences are evident. For example, Hue 130° (bluish green) potentially works well under fluorescent tubes but not under metal halide or LED emission. Hue 0° (red) would be suitable under metal halide illumination but not for the other types. The position of the mid-grey point is significant also. Some colourisations are inclined to lock up print shadows or highlights. The colour matrix, above, shows where this is likely to occur.

Further information can be obtained from colour matrix #3. *Illustration 6.4.2.8*, below, is an enlarged presentation of sections from the colour-matrix above (*Illustration 6.4.2.7*) with the colour remove to facilitate examination for mottle and unevenness of printing. Close examination shows that the areas printed under LED illumination were mottled and grainy. The fluorescent tube exposures appeared smoother; the metal halide exposure fall somewhere between the two. It has proved possible using this form of examination to distinguish between the graininess of different Hues under the same UV source, for example the penultimate row from the bottom of the Fluorescent tubes section appears slightly less grainy than other Hues.

The following illustrations (*6.4.2.9*, *6.4.2.10* & *6.4.2.11*, below) repeat this argument using

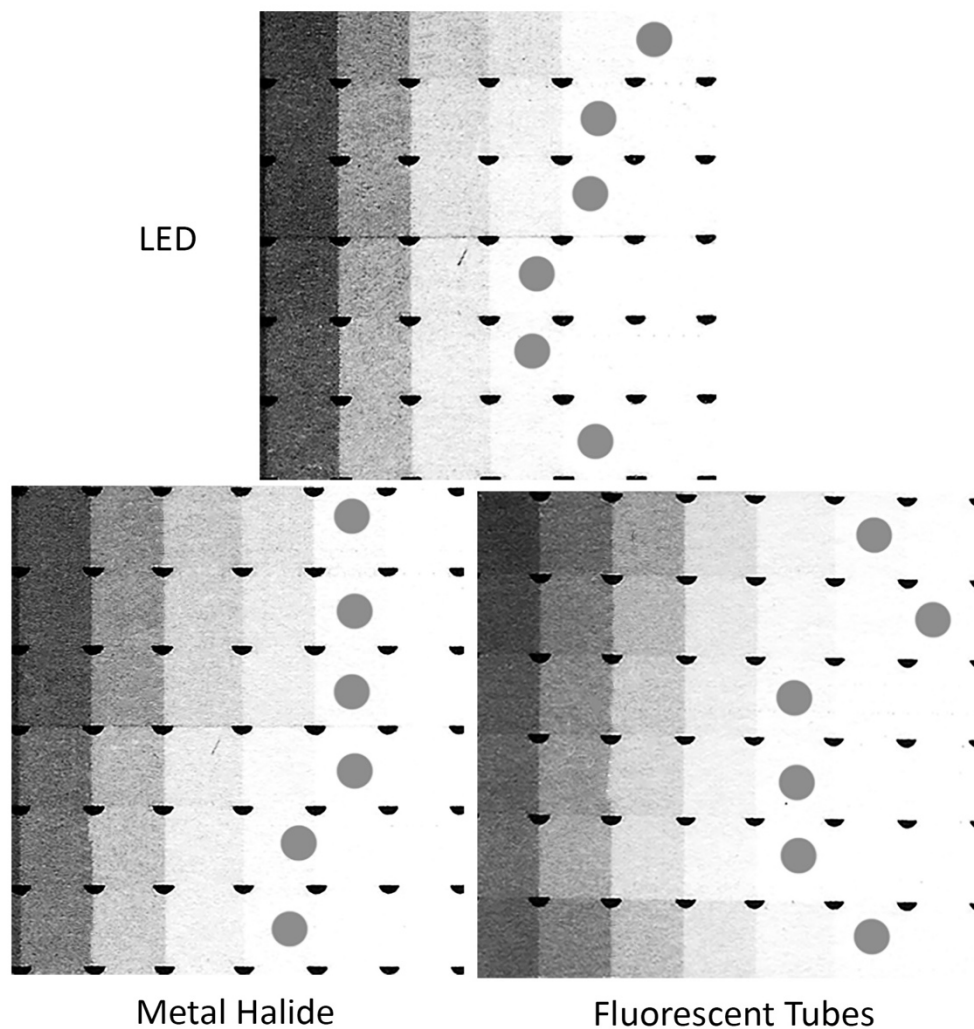


Illustration 6.4.2.8 Enlarged section of Platinum/palladium print of Colour Matrix #3
Image de-saturated to better show variations of print mottle

the results from Cyanotype exposure of the Colour Matrix #3 under the three UV sources. The emissions spectra of the three lamps evidenced differentially opacity to the selected Hue rows and the different hues produced varying levels of print mottle and print smoothness. In the case of Cyanotype printing, it appeared that the metal halide lamp produced better tonal differentiation and smoother and less mottled tone than the fluorescent tubes and LED matrix (*Illustration 6.4.2.12*, below). This procedure – exposure of Colour Matrix #3 under different UV sources – provides a technique for comparison of the effects of negative colourisation and allows selection of Hue ranges which can minimise tonal distortion through ‘linearisation’ and ‘calibration’ and optimise tonal differentiation whilst reducing mottle and other artefacts.

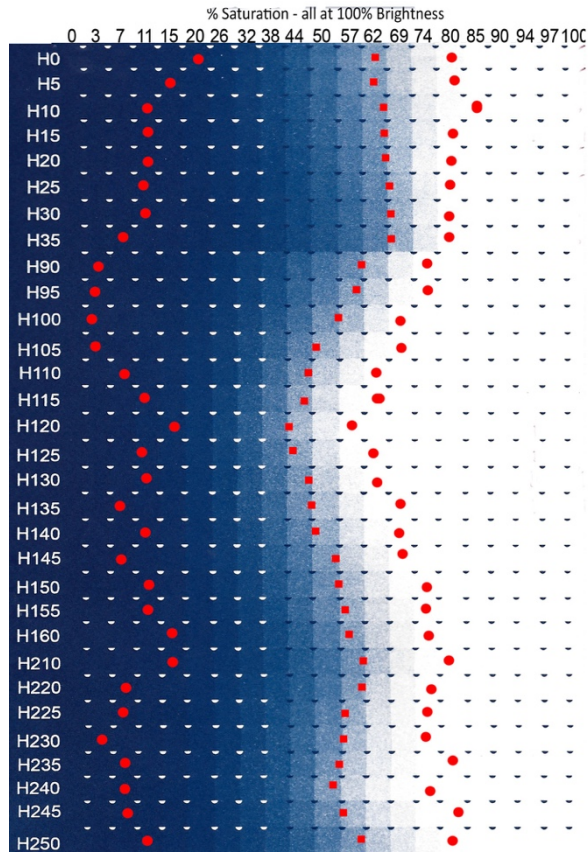


Illustration 6.4.2.9

Cyanotype print of Colour Matrix #3
Metal Halide bulb exposure

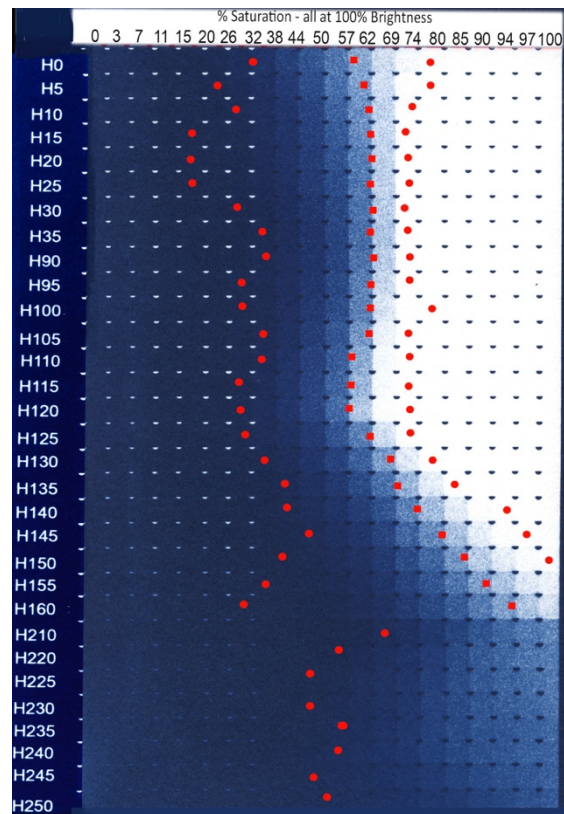


Illustration 6.4.2.10

Cyanotype print of Colour Matrix #3
LED exposure

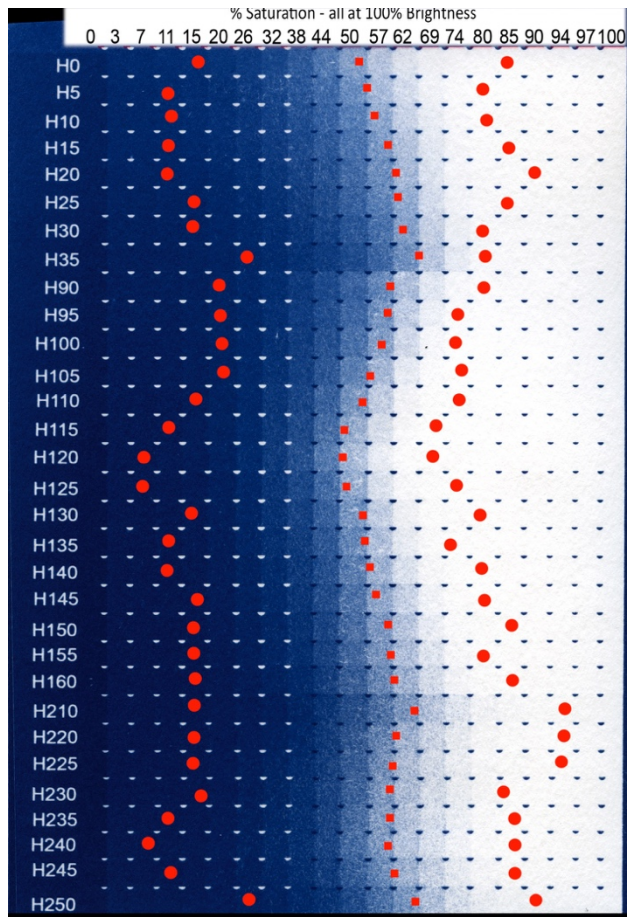


Illustration 6.4.2.11 Cyanotype print of Colour Matrix #3
Fluorescent tubes exposure

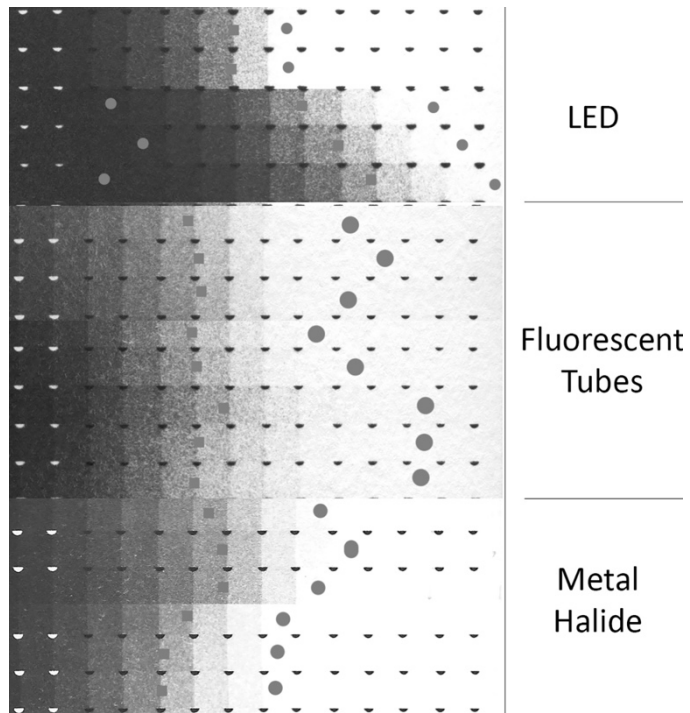


Illustration 6.4.2.12 Extracts of Cyanotype print of Colour
Matrix #3 (desaturated), showing print mottle by Hue row.

Chapter Seven

Performance of the print – material syntax

This Chapter reports the vernacular lexicon offered by respondents as they described prints that had been prepared using ‘early’ photographic contact-printing processes. The primary objective of this strand of the empirical investigations was to explore how respondents describe prints and whether the material performances and presentations of the images had resonance for the viewer. The preliminary sections of this Chapter provide a theoretical context and background for the experiments and consider some of the psychological, philosophical and cultural analysis approaches to examination of ‘aesthetic’ response. These are followed by a description of the research methods and the Chapter continues with the presentation and analysis of the vernacular lexicon.

7.1 Theoretical context

Cultural, physiological and psychological investigations employ diverse conceptual frameworks in their analyses of ‘aesthetic’ responses. However, there is a paradigmatic continuum evident across these disciplines: acknowledgement of the social and constructional at one pole contrasting with a more reductionist and exclusionary focus at the other. Empirical inquiry into aesthetic response appears to fall within three main groupings. Firstly, there are the “*how*” questions (Cela-Conde *et al.*, 2011; Rentschler *et al.*, 1988; Jacobsen, 2010) – how are the neurological, physiological and psychological structures and processes of individual aesthetic responses constructed and executed? In the second category, interest extends both to the specific attributes of artefacts that stimulate response (Pederson *et al.*, 2011) and to the conceptual domains that may categorise their viewers’ descriptions – here, concerns about the “*what*” are privileged over those of the “*how*” (Jasson-Boyd & Marlow, 2007; Jacobsen, 2006; Leder & Nadal, 2014). In the fields of

computational analysis and image manipulation, for instance, there has been prolonged interest in the machine categorisation of image quality and other metrics, including sharpness, colour and contrast (Ming-Kai, 2009; Tchan, 1998).

More recently, and this constitutes a third broad grouping, conceptual frameworks – including some psychological models – have been developed that explicitly acknowledge both the cultural ascription of value and meaning to artefacts and the social mediation of individual appreciation (Leder, 2004). ‘Modern psychological approaches to aesthetics are aimed at taking also into account higher-level cognitive processes (e.g. familiarity, expectation, implicit and explicit knowledge structures of the perceiver) and emotions’ (Istók *et al.*, 2009: 184). This might for, psychological enquiries, be described as a matter of “*contextualisation*”, though for cultural theorists the “*social construction and ascription of meaning*” gives a more appropriate indication of their alternate focus of interest (Edwards, 2002; Keane, 2003; Rose & Tolia-Kelly, 2012)

Physiological texts (Rogers, 2010; Trobe, 2001; Wandell, 1995) offer detailed and comprehensive accounts of the structure and functioning of the human visual system – its facility to discern point, line, form, luminosity and colour, and abilities to infer shape, volume, spatial location and movement, and consequently to identify objects and relationships. Whilst the complete network of neurological activity may not yet be defined, the physiological fundamentals of vision and perception are well understood, though structuring and processing of aesthetic sensibility remain contested. Semir Zeki (1999) introduced the title *neuro-aesthetics* to describe his ‘biological basis of aesthetic experience’, and Ramachandran & Hirsten (1999) claimed to discover the neurological ‘key to understanding what art really is’. However, as John Hyman (2010: 245) argues, their models of neurological functioning are informed by idiosyncratic, problematic and disputed examples of ‘what art is’. Di Dio Cinzia & Gallese Vittorio (2009: 686) report the complexity of issues involved in

understanding the neural correlates associated with aesthetic experiences, and an absence of consensus on its very nature. 'The evidence... suggests that aesthetic experience – not differently from the perception of any visual object – only begins with a visual description of art works. In fact, sensorimotor and emotional processes are also in place, which colour aesthetic experiences with embodied motor and affective responses'. Neuro-aesthetic theorisations that do not address the potential for cultural ascription, and consequential 'embodiment of affect' in place prior to the neurological event, fail to address the specifically aesthetic aspect of stimulus response.

The fields of enquiry seeking to examine the properties of artefacts and the conceptualisations of their aesthetic appreciation – my second category, above – are well populated. As outlined in Chapter Six, a good deal of commercial and academic attention is paid to the qualities of image display and print reproduction, and to the identification of those attributes that are deemed to be significant to the viewers' experience (Pederson *et al.*, 2002; 2011). Algorithms capable of assessing digitally the 'quality' of images, and even whether they are 'aesthetic' or not, are well established, founded in the main on a common methodology where the evaluations of observers – lay or expert – are used through factor analysis to identify the image attributes deemed most salient to the appreciation of viewers.

In the case of photographic images, for example, factor analysis has determined: the relative ratings for viewer experience of contrast, grain and sharpness (Tinio *et al.*, 2010); composition, colour and depth of field (Pedro & Suryanarayan, 2012); blur, 'rule of thirds', chiaroscuro lighting, leading lines and altered viewpoint (Marchesotti, 2011); and perceptions of technical quality (Cerosaletti, 2009). A number of studies have used analyses of very large data sets obtained from Internet trawls, in one case up to 90,00 images (Yeh, 2014), where computational machines have been 'trained' to assess images and identify

attributes deemed to be significant. Sheroz Kan and Daniel Vogel (2012: 56) reviewed investigations of 'visual aesthetics in photographic portraiture'. They note,

'The typical approach for evaluating visual aesthetics in images is to extract features and model it as a machine-learning problem. Then, using a classifier, images are tagged as aesthetic or non-aesthetic; or, using a regression model, a prediction of the aesthetic rating is made.. This approach is essentially *searching* for a way to measure aesthetic quality rather than *understanding* principles which improve aesthetic quality'.
(original emphases)

In contrast, their declared aim was to select, *a priori*, a 'small number of rules' to specify targeted features, based upon their 'understanding of principles of aesthetic quality'. For every portrait photograph they considered no less than 66 '*traditional features*', including: colourfulness (for example, luminance, saturation and chrominance at various point across the image); spatial composition (for example, location and relative size of key facial features within the frame); and texture (for example sharpness, contrast, homogeneity). They claim for their 'top-down' approach, an improvement in machine ability to distinguish 'aesthetic' and 'non-aesthetic' portraits compared with the large data-set 'bottom-up' methods, though it must be noted that they share with the authors they critique an essentialist notion of the '*aesthetic*' as a property descriptor rather than a sensate response and relationship.

Approaches of this nature may be open to charges of *ahistoricism* or sociological/cultural naïvity. The studies ascribe '*aestheticness*' to artefacts according to some factorally correlated specification based upon presumptions of consumer taste. They consider the aesthetic experience neither as a contextualised or dynamic event, nor as susceptible to cultural mediation or personal history. Classifications of images as either '*aesthetic*' or '*non-aesthetic*' according to certain categorisations of their features, even where there may be agreement by many hundreds of social media users, provide minimal information about, and no explication of, viewers' experiences and the sense-making narratives they articulate for themselves. As Dorothee Augustin *et al.* (2012: 188) state, 'for visual art alone aesthetics

seems to be characterised by a great amount of variety in terminology on the one hand and relatively little differentiation on the other hand'. They note the variable and often undefined use of terms of aesthetic manifestation, such as *beauty, pleasure, preferability, interest, liking, and aesthetic affect*, amongst others. Helmut Leder and Marcos Nadal (2014: 445) offer a helpful distinction, to clear the ground somewhat.

'The psychology of art aims to characterise the psychological mechanisms involved in the appreciation of art, such as grasping an artwork's symbolism.. The psychology of aesthetics, on the other hand, aims to identify and describe the psychological mechanisms that allow humans to experience and appreciate a broad variety of objects and phenomena'.

In his overview of the psychology of aesthetics, Jacobsen (2006: 156) notes that 'a host of factors influencing aesthetic experience and behaviour have been identified throughout the course of research'. On the basis of psychological experimentation he lists as salient in respect of the object, for instance, its:

- symmetry or asymmetry
- proportion or composition
- complexity or simplicity
- novelty or familiarity
- semantic content as opposed to formal qualities of design.

And, in respect of the viewers, their:

- emotional state
- degree of interest in a stimulus appeal to social status or financial interest
- education and historical, cultural or economic background
- situational and contextual aspects.

The 'Collative-Motivational Model' developed initially by Berlyne (1960) focuses on viewer management of the positive and negative effects of arousal – too much is unpleasant, too little is uninteresting. More recently, with his 'appraisal of interest model', Paul Silvia (2005) identifies two strands as central to the formulation of viewers' interest in visual artefacts: an appraisal of novelty/complexity, and an appraisal of potential to manage the assessment and

assimilation of the visual information. These appraisal models have the particular benefit of reinstating the viewers as active participant in the management of their experience, providing theoretical space for cultural and event contextualisation as well as personal development and learning. They also shift the focus of attention with regard to the attributes of artefacts away from what might be considered reductionist attempts to determine medium-specific key 'aesthetic features' (contrast or depth of field, for example, in the case of photographs) towards the variable opportunities offered for viewer appraisal and their cultural and personal intellectual and emotional resources available to form and articulate responses.

Östen Axelsson's (2011) comprehensive investigation and review of the field identifies the character and intensity of the stimulus (brightness, saturation, complexity, for example) and respondents' capacities and predispositions for processing and comprehending the stimulus information as two commonly proposed primary structuring categories. Typically, these relate to the cognitive schemes of the respondent and their management of the particular arousal-potential of the stimuli – Gudrun Eckblad's Cognitive-Motivational Model for example (1981). These conceptual frameworks recognise historical and cultural antecedents' mediation of viewers' engagement with artefacts, together with their interest in, and arousal 'susceptibility' to, particular material attributes.

On the basis of his review of earlier models, Axelsson (2011: 15) categorises those factors that may shape aesthetic appreciation as: '(1) arousal potential primarily in the form of collative variables of stimuli (e.g., uncertainty or complexity), (2) proto-typicality of the stimuli or, broader, (3) their processing fluency, (4) cognitive appraisal of novelty-complexity of stimuli and coping potential, and (5) assimilation resistance'. He locates these within five key dimensions – identified as Hedonic Tone, Expressiveness, Interest, Uncertainty and Dynamism – and for each of these axes, he identifies a number of subordinate continua,

outlined in *Figure 7.1.1* below, that he describes as encompassing the constituent judgments of viewers' aesthetic arousal. Such *semantic-differential scaling* techniques (Johnson & Christenson, 2014) acknowledge by their design the multi-dimensionality of human response. However, these categorisation devices can obscure the respondents' engagement with the particularities of the stimulus artefact, neglecting its temporal fluidity and contextual ascription. None of the dimensions in *Figure 7.1.1*, below, can be understood (or experienced) independently of their cultural formulation; the articulation of 'expressiveness' or 'dynamics' or 'uncertainty' has meaning only within a particular social and economic environment.

Dimension	Continua
Hedonic Tone	Pleasant ↔ Unpleasant
	Harmonious ↔ Disharmonious
	Tasteful ↔ Tasteless
	Comfortable ↔ Uncomfortable
	Appealing ↔ Repulsive
Expressiveness	Expressive ↔ Expressionless
	Full of feeling ↔ Without feeling
	Soulful ↔ Soulless
	Significant ↔ Insignificant
	Full of life ↔ Lifeless
Interesting-Uninteresting	Familiar ↔ Unfamiliar
	Common ↔ Rare
	Expected ↔ Unexpected
	Comprehensible ↔ Incomprehensible
Uncertainty	Simple ↔ Complex
	Without contradictions ↔ Full of contradictions
	Unambiguous ↔ Ambiguous
	Enigmatic ↔ Obvious
Dynamic	Dynamic ↔ Static
	Eventful ↔ Uneventful
	Lively ↔ Quiet
	Active ↔ Passive
Adapted from Axelsson (2011)	

Figure 7.1.1

Bulot & Reber's (2013) framework is unusual in its specific articulation of the *appreciators'* (their preferred term) prior cultural artistic exposure and explicatory capacities. Bulot & Reber's '*modes of appreciation*' of aesthetic stimuli (*Figure 7.1.2* below) acknowledges the

cultural mediation of responses to sensory experience. Their model posits variable

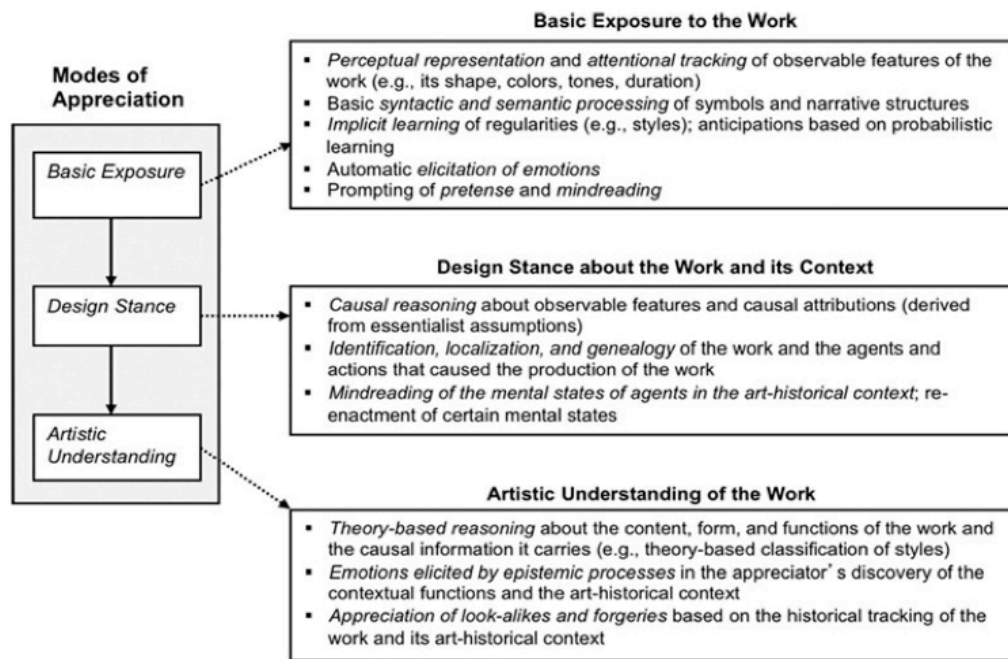


Figure 7.1.2
Three modes of appreciation of art posited by the *psycho-historical framework* Nicolas Bullot and Rolf Reber (2013)

sophistication and facility in the capacity of *appreciators* to bring cultural capital – including, for example, education, prior experience, and informed interest – to bear upon aesthetic stimulation.

In the context of such a broad and contested theoretical arena, I adopt modest and carefully circumscribed objectives in this aspect of my research. The approach I take aims simply to record the aesthetic and evaluative vocabulary as self-reported by *Response Groups* – mixed cohorts of lay-observers, experienced and inexperienced printmakers and photographers – on their exposure to prints produced using early and contemporary photographic contact printing processes. My purpose is to record something of the breadth and imagination of vocabulary and narrative provoked by the material performance of a selection of images, in order to draw inferences of the potentiality of surface and texture to colour sensory experience and affective response. The investigation is circumscribed by the nature of its

design. I recognise that my respondents brought their own experience, expertise and varied interests to this exercise, though I make no attempt to locate participants evaluations within the wider cultural milieu in which they were shaped and from which they take their meaning and value. The research was not designed to identify a set of aesthetically 'key' properties in respect of the materiality of prints, nor to produce dimensions or categories of aesthetic engagement (*pace* Axelsson, 2011). This strand of the project reports the language of viewers' responses and infers salience from their descriptions.

7.2 Material-syntax – investigative methods

A two-stage investigation was devised to record and analyse the vocabulary and terminology used by viewers to describe aspects of the materiality and appearance of a selection of images produced using a variety of nineteenth century contact printing processes. The procedures for the printing processes are described in the Appendix to Chapter Five.

Phase 1:

Pilot activities: 'Response Groups' viewing of *figurative* and *non-representational* prints. Individual examination, with some occasional casual group discussion and sharing of views, prompted listing of descriptive words on '*post-it notes*' allowing recording of the words/terms used by participants for description and evaluation of the prints.

Phase 2:

Main Response Group study: recording of open-ended individual written descriptions of sets of *representational images*, each set composed of prints of the same image made using selections from eight printing processes. Participants recorded their responses individually, discussion between members was not facilitated.

Respondents were encouraged to handle the unframed and unmatted prints. Their assessments took place in a variety of print studios, art rooms and classrooms. Conceptions

of the function of the print display are inevitably significant in shaping viewer responses and narratives. Images are rarely encountered in everyday life without clear environmental cues regarding the reasons for their presentation and the potential 'meanings' available for viewers to infer. Presumptions of purpose – be it, for example, for reasons of fine art expression or commercial marketing – shape the paradigms of interpretation available. In this investigation, attention was deliberately drawn to the nature and materiality of the prints, respondents were not discouraged from attending to the image content – indeed, several respondents commented on the appropriateness, or otherwise, of the nature of the process for the realisation of the image – but it was made clear that the investigator's interest lay in the print as artefact and not with the print as an art work or technical exercise or stimulus for market research. In the light of the responses a follow-up exercise is envisaged in order to examine whether the context and conditions of viewing affected responses using a semantic-differential scaling instrument with prints glazed and hung in a gallery setting. It has not been possible to complete this additional element within the time-scale of this project as the Gallery became unavailable, but the scaling instrument has been prepared.

7.3 Material-syntax – Phase 1: pilot exercise

This pilot phase of the research involved the viewing of non-figurative/non-representational images (*Illustration 7.3.1* below) and figurative prints (*Illustration 7.3.2* below) by members of six informal 'Response Groups'. The prints were produced by selected photographic contact-printing and reference processes, the processes were unidentified to the participants. The figurative prints were portraits taken from my professional practice, reflecting a variety of styles and subjects. The purpose was to test whether this approach – simply asking respondents to record what words and terms came to their minds when looking at different prints – produced usable data that might give an indication of their aesthetic, affective or cognitive reaction to the works. Respondents were verbally prompted to address

the *'feel'*, *'substance'*, *'nature'*, *'appropriateness'* and *'appearance'* of the print. Discussion between the participants was not facilitated, but occurred spontaneously in the informal setting.

7.3.1 Phase 1, Pilot exercise – Response Groups' protocol

Six 'Response Groups' viewed either a selection of abstract or non-figurative images (*Illustration 7.3.1.1 below*) or a selection of figurative images of varying sizes (*Illustration 7.3.1.2 below*) that were produced using early photographic contact-printing processes. A total of 35 people participated: students, artists and general public volunteers, all self-selected according to their random availability within a variety of educational and workshop locations. There was a cross section of ages, from 18 to 70 plus, a roughly equal gender balance, and a mixture of occupational experience, including students studying photography or art, printmaker practitioners and those with only a casual interest in art or photography. The unframed prints of various sizes were displayed on tables, desks and floors. Members were free to handle the works as they chose and were invited simply to record on *post-it* notes whatever words or terms came into their minds that they felt were in any way descriptive of the prints. No limit was placed on the number of words each respondent could offer. There was no requirement to comment on any or every print. Participants were free to talk with one another and to leave the activity at any time. The *post-it* notes were collected at the end of each session and the observations tabulated. In referring to the words offered by the participants, I variously and synonymously use 'terms', 'responses', 'descriptions', 'comments', 'contributions', 'vocabularies' and 'lexicons', as the context indicates, and distinguish (after Augustin *et al.*, 2012) between 'descriptors' of the materiality and productive qualities of the prints and their 'affective' reactive articulations of feeling, emotive or aesthetic response.

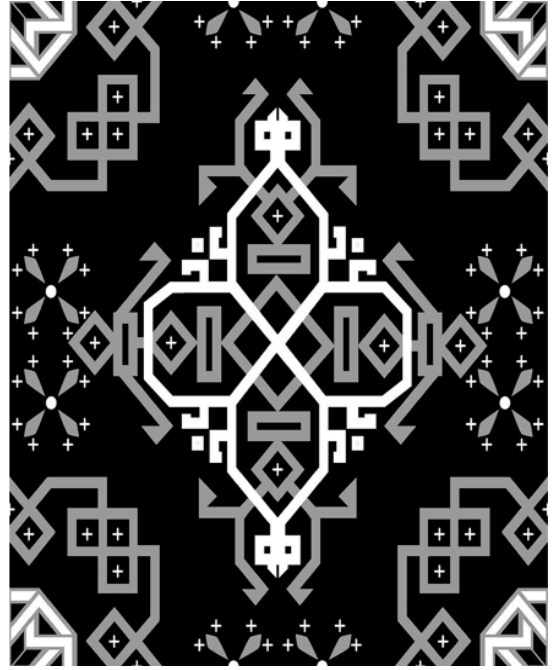
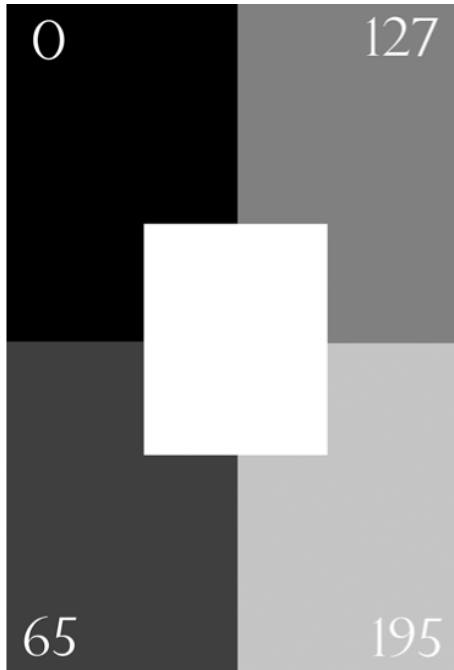
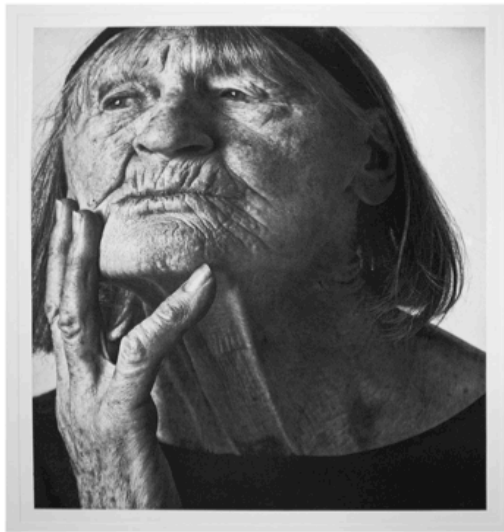
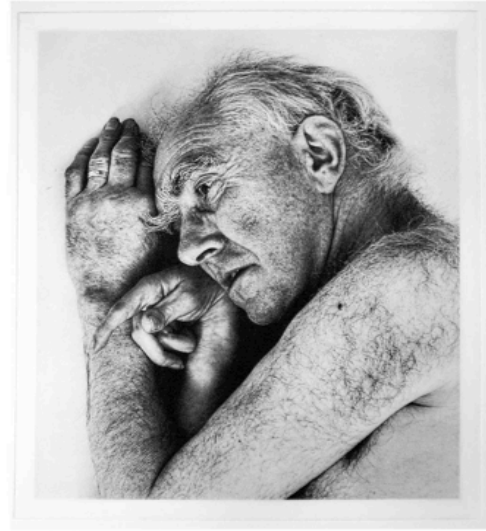


Illustration 7.3.1.1
Non-figurative/non-representational images *Phase 1*

Illustration 7.3.1.2 Sample figurative images Phase 1



7.3.2 Phase 1, Pilot exercise – Response Groups’ lexicon

A total of 155 descriptors (115 discrete terms) were recorded by Response Group members describing the prints and their responses to them. The *Phase 1* Response Group participants’ responses are tabulated as indicated below.

Table	Title	Page
7.3.2.1	Descriptors of non-figurative /abstract images	150
7.3.2.2	Descriptors of figurative images	150
7.3.2.3	Descriptors applicable to realisation/performance of the prints	152
7.3.2.4	Affective/aesthetic evaluations of the prints	152
7.3.2.5	Descriptors by print processes	154
7.3.2.6	Descriptors relevant to surface materiality and colour	155
7.3.2.7	Descriptors relevant to ‘quality’ of presentation	155
7.3.2.8	Affective/aesthetic descriptors by print process	156

A full listing of the descriptors is tabulated in *Tables 7.3.2.1 and 7.3.2.2*, below. The mean number of descriptors provided per participant was 4.4; the most prolific commentator offered 12 descriptors and the least gave just one observation. Not all participants commented on each print process, but where the process was identified platinum prints evoked the highest level of response (38 comments, 25% of the total identified), followed by cyanotypes (22%), carbon-transfer (21%), photogravure (18%) and salt prints (17%).

This pilot phase demonstrated that participants understood the purpose of the exercise, they generated a broad lexicon of pertinent description. Excluding colour words – cyanotypes labelled ‘*blue*’ for example – all of the terms appear to be ‘general’ descriptors and not specific to particular classes of print processes. *Table 7.3.2.1*, below, lists terms offered in respect of prints of non-figurative images. The terms appear mainly to be descriptors of the materiality of the prints and of the qualities of their reproduction. With the non-figurative prints, there are few comments that indicate affective responses – ‘*rich*’, ‘*pleasant*’ and

Table 7.3.2.1

Phase 1 Response Groups' descriptors (duplicates removed) of non-figurative images

blue	dirty-brown	no-contrast	sepia
blue-grey	dull	old-fashioned	shadowy
blurry	earthy	painted	sharp
boring	flat	patterned	shiny
boxed	focused	pleasant	spotty
brown	foggy	pointless	texture
coarse	fuzzy	rectangular	tonal
cold	gloss	regular	umber
contrasty	grainy	relief	warm
crisp	grey	ribbed	warm-black
dark	heavy	rich	weave
dim	mottled	rough	

Table 7.3.2.2

Phase 1 Response Groups' descriptors (duplicates removed) of figurative images

authentic	dull	muddy	smooth
bleached	dusty	mysterious	snazzy
blotchy	earthy	nice	soft
blue	electric	not working	space
brooding	even	nothing lost	speckled
brown	excited	old	spotted
chalky	eye-catching	organic	staged
character	faint	painterly	stiff
classical	fibre	pitted	stilted
clean	flat	plush	strong
coarse	flowing	polished	subtle
cold	foggy	potent	tactile
contrast	fuzzy	powerful	tangible
convincing	gloss	precise	textured
copper	glow	pure	thick
creative	grainy	quality	tonal
crisp	granular	real	touching
crude	grey	realistic	traditional
crumbly	gritty	red tint	uneven
curved	imperfect	reflects age	uniform
cute	intense	rich	vague
dark	layered	robust	Victorian
definition	light-toned	rough	vigorous
delicate	long ago	sandy	warm
dense	lots of values	scratchy	weighty
depth	lustrous	sepia	wet look
detailed	matte	shadowy	window-like
different	messy	sharp	yellow
disturbing	messy frame	shine	

'pointless', are the exceptions. Other than *'boxed'* and *'rectangular'* there are no other comments which focus on the image content or design. The lexicon offered for the figurative images by contrast, *Table 7.3.2.2* above, is broader and more affective, the inference being that images of people are more likely to evoke sentiment than are those of abstract patterns. With the figurative images, as with the non-figurative prints, there are few terms here that appear to be a direct response to the image content, *'staged'* and *'convincing'* being possible exceptions – indexicality does not register strongly in the comments. There are though, in the responses to figurative prints, a higher proportion (53%) of comments – *'eye-catching'*, *'subtle'* and *'disturbing'*, for example – that are indicative of the participants' aesthetic responses than there are references to specific material qualities of the prints (47%).

Tables 7.3.2.3, below, in respect of both figurative and non-figurative images, lists all the comments that are descriptive of the materiality and qualities of the prints, terms that refer to the participants' affective responses are excluded. Around two thirds of these descriptors of materiality reference presentational and definitional qualities – *'muddy'*, *'crisp'*, *'blurry'* and *'warm-black'*, for example – the remainder describe aspects of the surface and tactility of the prints, as with *'granular'*, *'tactile'* or *'relief'*. These descriptors offer no information about the relative significance or saliency of the print attributes, nor about their relation with the more affective responses, but do provide evidence that the materialities and qualities are noticed, are describable, and, at least in one sense, are noteworthy.

Tables 7.3.2.4 below, again in respect of both figurative and non-figurative images, singles out those descriptors indicative of participants' aesthetic evaluation or *'feeling'* reaction to the prints. Whilst the vocabularies of print materiality, *Table 7.3.2.3* below, are evaluative also, they do not connote the states of mind or feeling on the part of the commentator that may be inferred from the terms in *Table 7.3.2.4*, below, where the descriptions include some

Descriptors referencing the materiality/appearance of the prints				
bleached	dim	matte	sepia	
blotchy	dirty-brown	messy	shadowy	
blue	dusty	mottled	sharp	
blurry	earthy	muddy	shiny	
boxed	even	no-contrast	smooth	
brown	faint	patterned	speckled	
chalky	fibre	painted	spotted	
clean	flat	pitted	tactile	
coarse	foggy	polished	texture	
contrast	fuzzy	precise	thick	
copper	gloss	rectangular	tonal	
crisp	grainy	red tint	uneven	
crumbly	grainy	relief	uniform	
dark	granular	ribbed	warm	
definition	grey	rough	warm-black	
definition	gritty	sandy	yellow	
detailed	light-toned	scratchy		

Descriptors referencing affective/aesthetic evaluations of the prints				
authentic	different	lots of values	pure	stiff
boring	disturbing	lustrous	quality	stilted
brooding	dull	mysterious	not working	strong
character	electric	nice	real	subtle
classical	excited	not working	realistic	tangible
cold	eye-catching	nothing lost	regular	touching
convincing	flowing	old	rich	traditional
creative	focused	old-fashioned	robust	umber
crude	glow	organic	soft	vague
curved	heavy	pleasant	space	Victorian
cute	imperfect	plush	staged	vigorous
delicate	intense	pointless	real	weave
dense	layered	potent	realistic	weighty
depth	long ago	powerful	regular	wet look
				window-like

quite powerful attributions. ‘Vigorous’, ‘intense’, ‘boring’, ‘potent’ and ‘crude’ are not mealy-mouthed terms of indifference. Words like *Victorian*, *traditional*, *classical*, *old*, *painterly*

allocate a certain archaic status to the processes and might be considered ways of contextualising the prints within the respondents' own appreciation of the history of art. On the other hand, *mysterious, cute, brooding and disturbing* are perhaps more indicative of personal responses to the print subjects and treatments.

On first consideration, this distinction, between descriptions of the material appearance or qualities of the prints and the interpretative comments indicative of an affective evaluation from the viewer, appears unproblematic – '*dusty*' is descriptive, but '*earthy*' is affective, '*faint*' is descriptive but '*delicate*' is affective. Augustin *et al.* (2012: 186) in their study of aesthetic vocabularies refer to an *affective–descriptive* dimension, and all the *Phase 1* descriptors (and those of *Phase 2*) can – on first consideration – readily be assigned to one category or another. It is, though, a rare descriptor that carries no affective connotation: *dusty* and *faint* are not without emotional resonance, whilst *dull* or *delicate* can be as descriptive of appearance as of feeling. Similarly, with non-technical descriptors of images, the 'valence' of the vocabulary – that is, whether the respondents' comments imply critical or positive affect – is not always straightforward to evaluate. Although '*blotchy*', for instance, might reliably be taken as a negative or critical description, '*shadowy*' might, depending on the reading of the image content, indicate affective approval. Categorisations can be helpful in grasping a sense of the meaning of participants responses, and I use them extensively, but I do not assume such distinctions are definitive, and I treat classificatory dimensions of, for example, 'affective/descriptive' and 'positive/critical', as open to fluid interpretation.

The words offered by *Phase 1* Response Group respondents were in response to prints made using five processes. *Table 7.3.2.5* below, shows their attribution of descriptors to each type of print. Salt prints prompted the smallest number of process-specific descriptors (17% of the

<i>Table 7.3.2.5</i> <i>Phase 1 Response Groups</i>				
Descriptors by print processes				
Platinum	Cyanotype	Carbon Transfer	Photogravure	Salt
brooding	bleached	brown	character	authentic
classical	blotchy	brownish	coarse	brown
contrast	blue	cold	contrasty	copper
crisp	chalky	dark	convincing	crisp
definition	clean	dense	crumbly	detailed
dense	coarse	depth	delicate	earthy
depth	cold	detailed	dense	faint
detailed	creative	different	disturbing	flat
electric	crude	dull	dull	grainy
flat	curved	earthy	excited	gritty
gloss	cute	even	flat	matte
glow	delicate	eye-catching	foggy	muddy
intense	dusty	flat	nothing lost	plush
layered	fibre	flat	old	quality
long ago	flat	flowing	painterly	real
lots of values	fuzzy	grey	pitted	red tint
messy	grainy	imperfect	potent	reflects age
muddy	granular	layered	powerful	rich
nice	gritty	lustrous	rough	sandy
powerful	light-toned	muddy	shadowy	sepia
pure	messy frame	mysterious	soft	snazzy
real	not working	polished	spotted	strong
realistic	organic	precise	tangible	traditional
rich	painterly	smooth	texture	vague
rough	robust	soft	textured	warm
sharp	rough	staged	uneven	warm tone
shine	scratchy	stiff	weighty	
shiniest	soft	stilted		
shining	space	tonal		
strong	speckled	Victorian		
tactile	subtle	warm		
thick	textured			
touching	uneven			
uniform	vigorous			
warm				
wet look				
window-like				
yellow				

<i>Table 7.3.2.6</i> <i>Phase 1 Response Groups</i>				
Descriptors relevant to surface materiality and colour				
Platinum	Cyanotype	Carbon Transfer	Photogravure	Salt
rough	bleached	brown	coarse	brown
shine	blotchy	brownish	crumbly	copper
shiniest	blue	grey	pitted	earthy
shining	chalky	muddy	spotted	grainy
tactile	clean	smooth	texture	gritty
thick	coarse		textured	matte
touching	dusty		uneven	muddy
uniform	fibre			red tint
yellow	grainy			sandy
	granular			sepia
	gritty			
	rough			
	scratchy			
	speckled			
	textured			

<i>Table 7.3.2.7</i> <i>Phase 1 Response Groups</i>				
Descriptors relevant to 'resolution'/'sharpness' and quality of presentation				
Platinum	Cyanotype	Carbon	Photogravure	Salt
contrast	flat	detailed	contrasty	crisp
crisp	fuzzy	flat	flat	detailed
definition	light-toned	imperfect	foggy	faint
detailed	messy frame	soft	soft	flat
flat	soft	tonal		
gloss	uneven			
messy				
muddy				
sharp				

total offered), platinum prints stimulated the most comments (28%). *Table 7.3.2.6*, above, presents these process descriptors that refer to print surface materiality, texture and colour. *Table 7.3.7*, above, categorises the comments by process and print ‘qualities’ such as contrast and resolution. *Table 7.3.2.8*, below, lists the respondents’ descriptions, by print process, that indicate affective response or aesthetic evaluation.

Platinum	Cyanotype	Carbon Transfer	Photogravure	Salt
brooding	cold	cold	character	authentic
classical	creative	dark	convincing	plush
dense	crude	dense	delicate	quality
depth	curved	depth	dense	real
electric	cute	different	disturbing	reflects age
glow	delicate	dull	dull	rich
intense	not working	earthy	excited	snazzy
layered	organic	even	nothing lost	strong
long ago	painterly	eye-catching	old	traditional
lots of values	robust	flowing	painterly	vague
nice	space	layered	potent	warm
powerful	subtle	lustrous	powerful	
pure	vigorous	mysterious	rough	
real		polished	shadowy	
realistic		precise	tangible	
rich		staged	weighty	
strong		stiff		
warm		stilted		
wet look		Victorian		
window-like		warm		

The categorisations presented in these three tables (7.3.2.6, 7.3.2.7, 7.3.2.8, above) do not evidence significant difference between the five processes in terms of the *Phase 1* participants’ commentary on the surface, materiality and ‘quality’ of presentation. All process receive what may be interpreted as ‘non-favourable’ evaluations – ‘coarse’, ‘rough’, ‘pitted’, ‘muddy’, ‘flat’, ‘gritty’ and ‘speckled’, amongst others. There were, though, some more ‘positive’ attributions, ‘detailed’, ‘crisp’, ‘tactile’ and ‘tonal’, for example. On balance,

platinum and carbon-transfer prints received a more favourable balance of ‘positive’ against ‘negative’ comments. Interestingly, insofar as print contrast/definition is significant to respondents, they deploy a wider vocabulary of ‘critical’ rather than ‘positive’ evaluation. Each process was described as *‘flat’* by at least one respondent. The tonal range of early print processes is rarely as broad as inkjet, silver gelatine or commercially produced prints and is significantly below that of screen displays on computers or mobile devices. It is possible that respondents’ commentary on the contrast of the prints was informed by their familiarity with contemporary productions. *Phase 2* investigations, in consequence, included gloss and matt inkjet prints as comparators.

These apparently ‘negative’ or ‘critical’ evaluations used to describe the material and quality aspects, particularly of photogravure and cyanotype, are not evident in the descriptors of the prints’ more expressive qualities. The attributions to particular processes shown in Table 7.3.2.8, above, with only a few exceptions – *‘stiff’*, *‘crumbly’*, *‘cold’* – could be considered as indicative of affective impact. Whilst the same or similar terms are applied across the range, it could be inferred that photogravure and platinum processes are seen as demonstrating a certain *‘gravitas’*, to add my descriptor to the list, and perhaps a broader potential for affective communication. To adopt a musical metaphor, they sing the tenor line, whilst cyanotypes seem to have a sharper, almost strident contralto voice. To stretch the metaphor perhaps too far, carbon prints, despite their close surface resemblance to some modern silver gelatine processes, take the base and salt prints the baritone registers.

7.3.3 Phase 1, Pilot exercise – observations

Participants in Phase 1 were invited to inspect, handle and comment on the materiality and

articulation of a selection of prints produced using five 'early' photographic printing processes. They appeared to have no difficulty in doing so and produced an extensive descriptive lexicon from which it can be inferred that the materiality of the print has potential saliency for viewers' aesthetic and affective engagement. The lexicon offered is extensive and powerfully descriptive in varied, direct and occasionally sophisticated and imaginative terms. Whether the respondents would have paid such attention to the material aspects had they not been invited so to do and were free to attend to the content of the images rather than their presentation, remains an open question.

7.4 Material-syntax – Phase 2 – open-ended questionnaire responses

Building on the pilot exercise, this second phase was undertaken to provide respondents with a more considered opportunity to record their observations and to be able to compare the same image presented using different processes. The approach was intended to take some account of the significance of image content and design in the formation of aesthetic response. Participants were invited to provide individual written descriptions of a series of five representational images, each composed of prints of the same image made using seven processes.

7.4.1 Phase 2 protocol

Five images, shown below *Illustration 7.4.1.1*, were selected from my current portraiture project and my 'Arbour' series, and sets of prints were produced using cyanotype, platinum/palladium, salt, albumen, photogravure, carbon transfer and, for comparative purposes, inkjet (matt and gloss) printing processes. The instructions to the respondents are shown in the box below. 21 volunteer respondents – self-selected from student, artist and general public groups with a range of age, gender, art interests and experience – were invited to view individually the series of prints and complete a questionnaire recording

Instructions to Phase 2 participants

Photographic prints – how they look and appeal

The purpose of this exercise is to explore aspects of the ways people respond to photographic prints produced by different processes. I'm interested in the words we use to describe prints and in our emotional as well as technical and intellectual responses.

This is in not a 'test' of people's knowledge of the latest photography theories; I'm simply trying to capture something of our vocabularies and ways of understanding and responding to photographic prints.

Your comments will remain anonymous, I will not need you to include your name on any of your written or recorded responses.

Questionnaire

You will be shown a series of photographic prints produced by different processes and invited in the following pages to note down words (not necessarily expressed as complete sentences) that come to your mind to describe the prints and how you feel about them. Spontaneous responses – words that just come into your head - are as important as more considered responses.

their descriptions of and responses to the works. There was a approximately equal gender balance of participants. Seven were undergraduates studying printmaking, photography or art. The average (modal) age of the remainder was around 30 years, with a range from 25 to 92 years, and their occupations were predominantly craft-based self-employed, public sector, or business management. All participants were volunteers who came into contact with this project through attendance at art-events or workshops or who had heard about the exercise from earlier participants. All participants had at least a passing interest in artworks, though not necessarily in either photography or printmaking. The number of participants was small compared with large scale investigations of factorial relationships, but of sufficient size to provide generous evidence of vocabulary and response that was the research's

objective. Because this was a pen and paper exercise, there was little interaction between the participants.

The prints of the five images, illustrated below *Illustration 7.4.1.1*, were identified only by reference number, no information of their mode of production was provided to the participants. No time limit was placed on the exercise and there was no requirement or encouragement for respondents to view and comment on all five sets or all images from each set, and in the event no participants did so – on average, participants commented on 15 prints. The average time for completion of the exercise was approximately twenty five



Image 1.

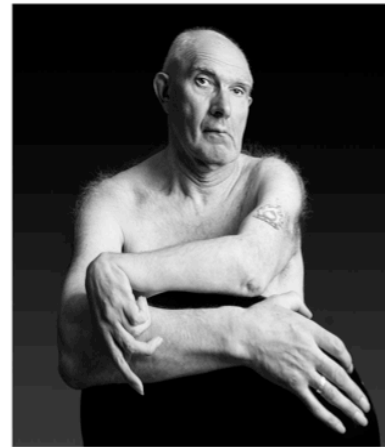


Image 2.



Image 3.



Image 4.



Image 5.

Illustration 7.4.1.1 Material-syntax – Phase 2 – images produced as

minutes, though one participants spent over an hour examining the prints. As a general rule, there is little opportunity physically to handle other people’s photographic prints, particularly ‘art-prints’. Vernacular digital images though frequently shared are usually viewed on screen, without material realisation, and older family photos (hard copies) are probably now kept mainly for occasional retrieval and family viewing. Certainly, photographs and prints up for exhibition or public display are kept at a suitable viewing and non-touching distance, invariably behind glass. *Phases 1* and *2* of this investigation were unusual in the encouragement given to hold the prints and inspect them at close quarters.

7.4.2 Phase 2 – overview of questionnaire descriptors

In contrast to the Phase 1 reliance on *post-it* notes, the use of A4 pre-printed questionnaire proforma, to be completed individually and privately, appears to have encouraged respondents to offer both descriptive phrases and single words. A total of 577 descriptors, with 296 discrete terms, have been identified in *Phase 2* questionnaire returns. This compares with the 155 descriptors contributed by the larger number of Response Groups’ participants. The mean number of descriptors offered by each *Phase 2* participant was 27, significantly higher than in *Phase 1* where it was just over 4.

The presentation of the *Phase 2* findings is supported with data within this text, as set out below:

Table	Title	Page
7.4.2.1	<i>Phase 2</i> – respondents’ lexicon (duplicates removed)	163
7.4.2.2	Most frequent terms volunteered	135
7.4.2.3	Most frequent terms - categorised	166
7.4.2.4	Most frequent terms by process – platinum/palladium	168
7.4.2.5	Most frequent terms by processes – gravure, albumen & cyanotype	170
7.4.2.6	Most frequent term by processes – carbon-transfer & inkjet	171
7.4.2.7	Allocation of descriptor ‘dark’ to different processes	172
7.4.2.8	Selected descriptions of tree image	173
7.4.2.9	Descriptors offered in both phases	174

The *Phase 2* questionnaire pro-forma provided specific spaces, numbered by subject and process, for participants to comment on prints. All responses were confined within this structure – no participant made any general observations about the print series as a whole, or any “out-of-the-box” commentary. Compared with *Phase 1*, where responses were almost entirely single-word observations, in *Phase 2* there was not only a considerably larger number of terms offered overall, but also a much greater use of descriptive, and often carefully qualified, commentary. For example, reference was made to ‘*the natural feel of the paper*’ compared to the ‘*unnatural colour of the print*’, to the ‘*wonderful contours of the skin*’, to ‘*the arresting blue tones*’, to a print being ‘*best for facial character*’ and to ‘*chiascuro very effective*’. These are thoughtful observations and a testimony to the levels of interest and application shown by the respondents. A consequence of the more sophisticated phraseology employed in *Phase 2* is the coding of the terms offered recognised that a single comment may contain multiple descriptors which can be relevant to a number of quality attributes of the print, to its materiality and also to the aesthetic response of the participant. Whilst it has proven convenient to maintain the distinction used in *Phase 1* between ‘*Descriptors*’ and ‘*Affective*’ responses, as a way of handling the scale of the vernacular lexicon generated, it remains a fluid and certainly not a mutually exclusive categorisation. ‘*Lovely luminosity*’, for example, refers simultaneously to the subjective and aesthetic appreciation of the viewer, to evaluations of the print’s performance or realisation of the image, and to the production values of the process.

In total, over 500 terms were provided by the respondents. With the duplicated terms within each process excluded, the total number of terms falls, and is reduced further to 321 when all duplicates are omitted. The summary below in *Table 7.4.2.1* excludes duplicates.

<i>Table 7.4.2.1</i>		Phase 2 – Lexicon				<i>(duplicate terms excluded)</i>
aged	cool	gold	matt	real	strong	
airiness	craft	golden	mean	red	studio-lighting	
album cover	criminal	good	melancholia	reflection	stunning	
alienating	dank	grainy	menacing	reflective	subdued	
ancient	dark	great	metallic, rather	renaissance	subject projects	
animals tones	dated	grey	mid-tones, beautiful	reproduction, great	fantasy and infinite possibilities	
anxious	deep	gritty	mild	reproduction, powerful	sun	
appeal, lacks immediate	defiant	grubbier	milky	resonates	superimposed	
artificial	definition, high	hairy	milky	restrained, but present	surface, good sense of	
atmosphere, best	depth	haptic	modern printing	revelation	sweaty	
attractive, very	detail	hard edged	monumental	rich	sympathetic	
awe	dimensional	harmful	moody	rose-tinted	tactile	
background recedes	disgusting	harmony	mournful	rough	tangible	
Bah! an inkjet printer	dissolved	harsh	muddled	rounded	taut	
balanced	distant	hazy	mystery	sad	technology aware of	
beautiful	disturbing	heavy	feel of paper vs unnatural colour	scary	texture	
best	documentary	highlights, blown out	neutral	sculpture	thoughtful	
black, superb	doesn't work	historical feeling	nostalgic	sea	threatening	
bleached	Dostoevsky	historical	not engaging	secret meeting	three dimensional	
bloody	dramatic	human	not natural, milky	sense of past	timeless	
blue	dream-like	humanity	Notre dame	sepia	tones	
blurry	dull	ill	oily	shaded, more	touch	
boring	dying	image, powerful	old	shadows, depth	unbalanced	
bright	dynamic	impact, low	old fashioned	shapes, modelling good	uncertain	
bronze	earthy	imperfect	old photograph	shapes, strong	unforgiving	
brown	edgy	India	open	sharp	unreal	
bunched	elements very clear	ink less even	oppressive	shiny	unremarkable	
calm	emotional impact reduced	inspiring	outstandingly good	silk	velvety	
canvas	engaging	interesting	over-exposed	silver	vigorous	
cavemen	enjoyable	intimacy	over-bright	sitter, fits	vintage	
chalky	enlightenment	intriguing, less	painterly	skeleton	vivid	
challenging, less	exposure good	invention	pallid	skin greasy	vulnerable	
character in face	expressive, less	inviting	paper	smooth	waiting for something to happen	
charcoal	faded	Jesus	passive	smudgy	war-like feeling	
cheap	faint	jungle	past, in the	soft	warm	

<i>Table 7.4.2.1</i>		Phase 2 – Lexicon			<i>(duplicate terms excluded)</i>	
chiascuro, very effective	fairy-tale	kind	patterned	sombre strength	washed up, slightly	
chocolate	fake	leaves	perspective, deep	some time ago	water	
choice, my	fantastic world	likeable	photocopy	sorrowful	weak	
Christ	favourite	life-like	photographically right	spiritual	Wedgewood	
clarity impresses	first choice	light	plain	splendid	wet	
classic	flashy presentation	lines, strong	pleasant visual feel	spritely	whites, bright	
clean	flat	livid	portraiture, intriguing	stark	withdrawn, more	
clear	floating in water	long	pose, forceful	statue	wonky	
clever	freak	long time ago	precise	stone-age	yellower	
cloud	furry	lovely	preferred	storm is gathering	youthful	
cold	gentle	luminosity, lovely	present	straight print	yuck	
colourful	glass	manipulated	pride	strange	zombie	
constructive	gloomy	Manson	print, attractive finish	striking		
contrast	glossy	marble	process, suits image	stroke		

The range of responses evoked by the prints is very broad. It includes what present as evaluations of production, *'highlights blown out'* and *'background recedes'* for instance, along with affective responses such as *'disgusting'*, *'dank'* and *'oppressive'*. Comments identify material issues, *'grubbier'*, *'hairy'* and *'good sense of surface'* for example, and also reference image content and photographic performance – *'forceful pose'*, *'intriguing portraiture'*, *'Christ'*, *'Manson'* and *'storm is gathering'*. This vernacular lexicon is impressive both in scale and focus. It demonstrates sophisticated ability on the part of participants to engage both affectively and cognitively with the print as artefact, the print as reproductive performance and the print as photographic event and index. Something of the subtlety of the responses is lost from simple listings of their words, which lose context and qualification, but evidence of the aesthetic saliency – and potential potency – of the materiality and qualities of the print appears clear. *Figure 7.4.2.2*, below, illustrates the most frequently used terms (four references and above).

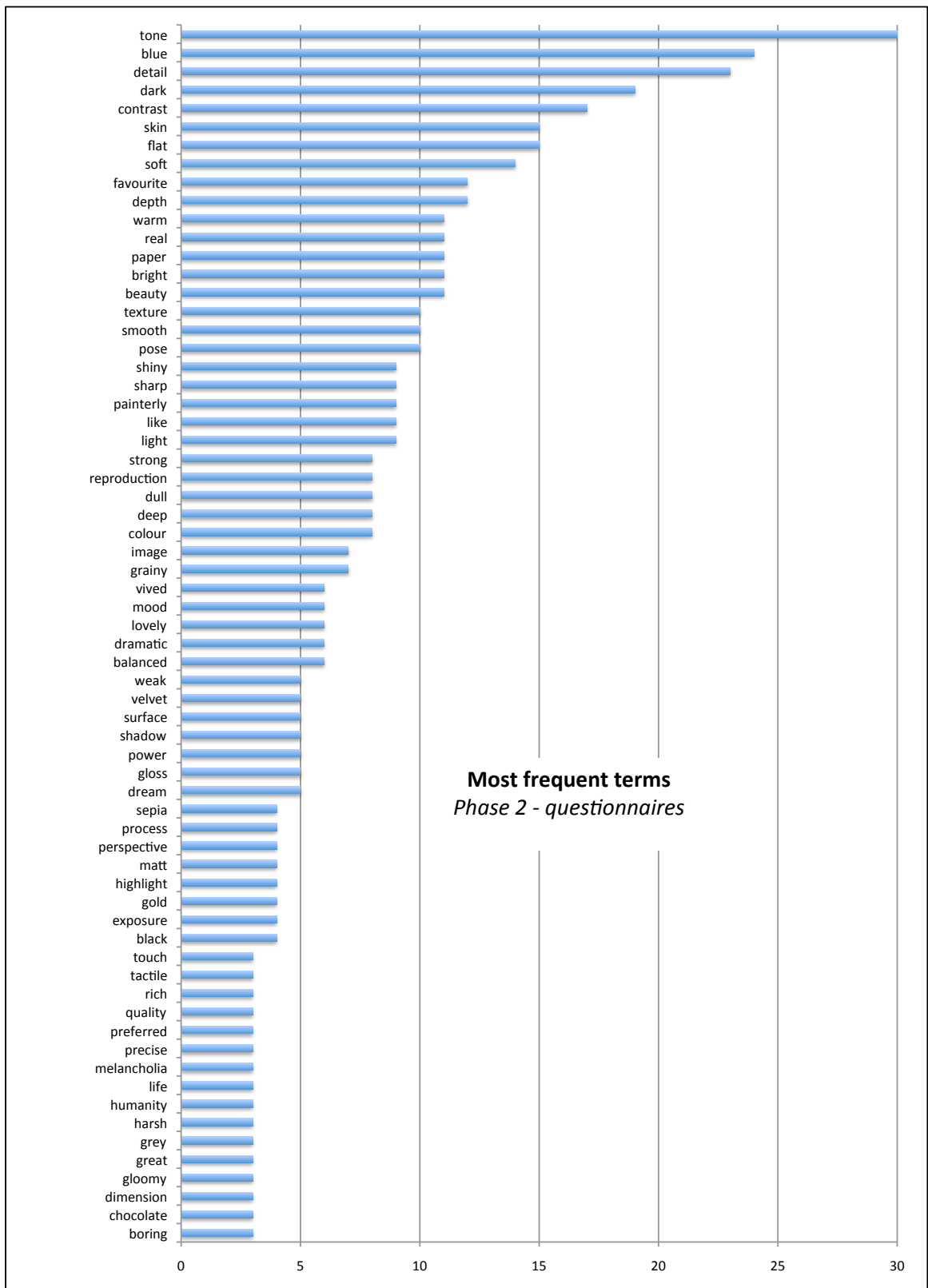


Figure 7.4.2.2

Figure 7.4.2.3, below, presents the frequently used terms within broad categories. The most populous category of comments includes descriptions of the general ‘appearance’ of the prints (25% of terms), where there is no direct reference to print production qualities and where the valency of affective connotation is open. Included here are terms such as ‘deep’, ‘classic’, ‘earthy’, ‘airiness’. The second largest grouping (30%), headed ‘appreciation’, includes explicit expressions of affect or evaluation such as ‘awe’, ‘beautiful’, ‘disgusting’, ‘dynamic’. ‘dying’, ‘taut’, and ‘moody’ that hold no immediately explicit reference to the physical features of print production, along with affective terms that may refer to print

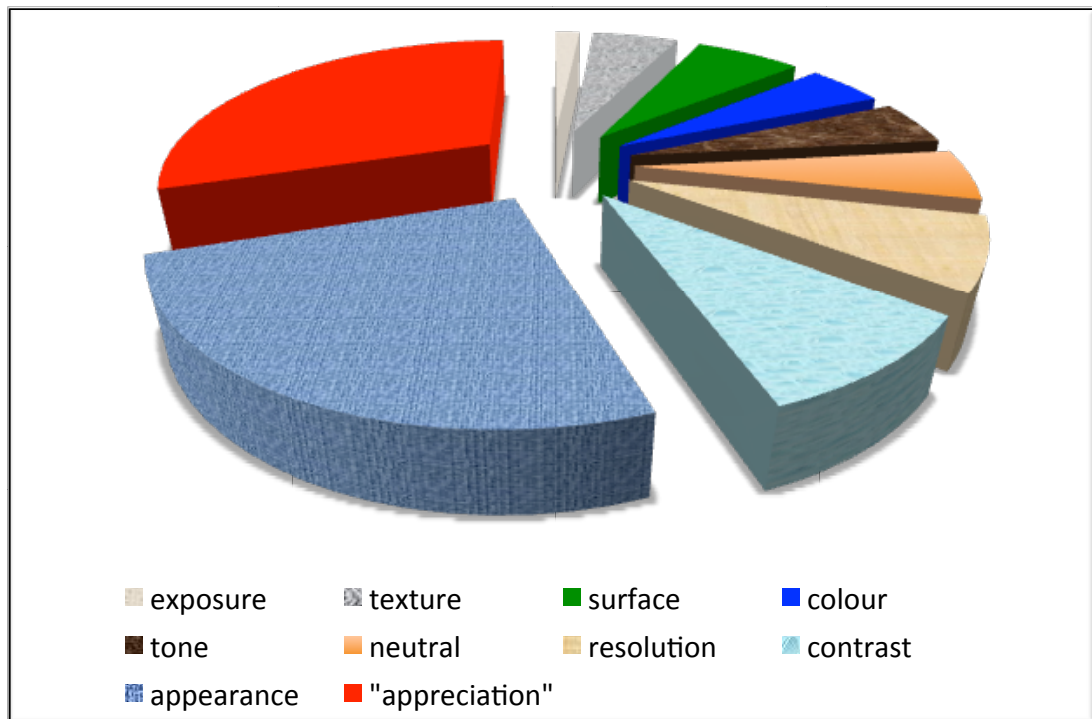


Figure 7.4.2.3

process – including ‘warmth’, ‘painterly’, ‘beauty’, ‘mystery’ and ‘drama’ – but are not directly referenced to specific material attributes.

The remainder (45%) of the comments are placed within categories that reflect specifically on the materiality and production qualities of the prints. The references are to print texture (6% of total terms), colour (5%) predominantly ‘blue’, mentioned 24 times in respect of cyanotype prints, surface (7%), resolution (7%), tonal differentiation (5%) and contrast (9%).

These are the 'descriptors', to use the terminology of Augustin *et al.* (2012, 186). The terms here reference the production values of the print processes, such as 'hairy', 'rough', 'blurry', 'flat', 'sharp', 'mid-tones', and 'chalky'. As emphasised above, broad categorisations of this nature conceal the subtlety and nuance of many of the original comments. Whatever the coding frame, terms may fall into two or more categories, or none, depending on inferences drawn about the authors' intended meaning. To provide another example, 'livid' offers more than an evocation of tonal values, it is an aesthetic engagement with the work that speaks both to the print process and the meaning it gives to the image. The use of 'velvet', too, is interesting. Judging by its context in the questionnaire responses, 'velvet' variously references the haptic and the physical feel of the print surface, the depth or darkness of colour, and the smoothness of the tones. 'Dark' is similarly ambiguous and multi-faceted as a commentary on the overall brightness of the print, the depth of the shadow areas or the emotional tone of the image subject. 'Soft' can, according to context, mean poor focus, or low contrast, or gentle even romantic handling of the image.

The number of comments and the employment of both 'affective' and 'descriptive' terminologies varies significantly according to print process. Of the total terms (including duplicates), over half were applied to photogravure (28%) and platinum/palladium (27%) prints. Of the remainder, 17% described carbon-transfer prints, the two inkjet and salt processes received about 10% each, but only 4% were attributed to albumen prints. It is not clear what underpins this distribution of comments. Participants made their own decisions about how to manage their time and interest and it is possible that their patience and persistence diminished towards the end of the exercise, though the series of prints were presented in no particular or repeated order. The categorisations of these responses are illustrated for each print process in *Figures 7.4.2.4, 7.4.2.5 and 7.4.2.6*, below. After the exclusion of duplicates within each process, the number of comments reduced to 114 (21%)

for photogravure, 118 (22%) for platinum/palladium, 69 (13%) for cyanotype, 74 (14%) for carbon-transfer, 49 and 50 each for the inkjets (18%), 51 (9%) for salt and 21 (4%) for albumen prints.

In all cases except cyanotypes, the majority of the comments were observations on general aspects of ‘appearance’ and affective terms of ‘appreciation’, both positive and apparently critical or negative. For example: ‘humanity’, ‘life’, ‘perspective’, ‘shadow’, and ‘pose’ are included under Appearance, and ‘power’, ‘gloomy’, ‘awe’, ‘beauty’, ‘dank’, ‘lovely’ and ‘quality’ are listed, for the purposes of these illustrations, under Appreciation. The descriptors of the material and process characteristics are grouped, as in *Figure 7.4.3* above, into categories of texture/tactility, tonality, surface, colour, resolution and contrast. Comments on print resolution, sharpness and detail figured prominently with inkjet (gloss)

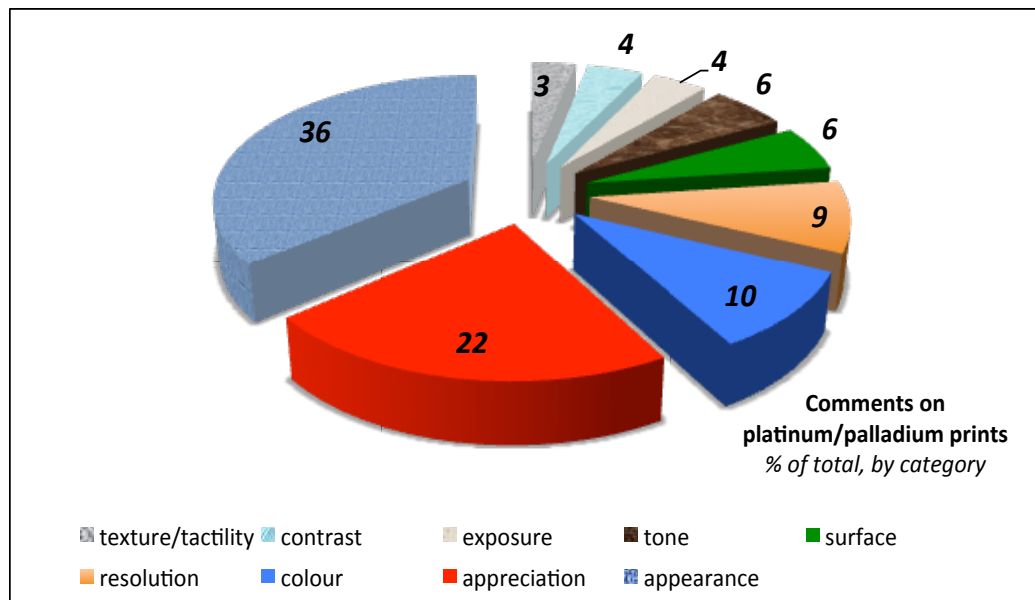


Figure 7.4.2.4

prints, ‘clear’, and ‘sharp’ for instance, and to a lesser extent with carbon-transfer prints, witness ‘high-definition’, and inkjet (matt) with its ‘clarity’ (*Figure 7.4.2.8* refers below). By contrast, participants recorded a ‘loss of detail’ and ‘least in detailing’ for photogravures, whilst platinum/palladiums were ‘smudgy’, ‘slightly blurry’ but also ‘very precise’, perhaps reflecting qualities of different prints. Texture and tactility were referred to proportionally

more frequently for photogravure – *'grainy', 'tactile', 'texture'* and *'velvet'* – and relatively rarely for the *'smooth'* inkjet (matt) and carbon-transfer prints. Cyanotype was described as having *'textured depth'* in one instance, and the image having *'sunk into the surface'* on another. With equal ambivalence, albumens were noted as *'rough', 'smooth'* and *'yuck'*, whilst salt prints had surfaces which *'held no interest'*, but had *'sheen'* and a *'shiny texture'*, though the paper *'did not feel good'*. The surfaces of platinum/palladium prints were described as *'marble', 'metallic' and 'velvety'* and *'fluffy'*. Similar ranges of comments were offered in respect of print contrast and its associated tonalities. Platinum/palladiums were *'high contrast'*, with *'depth of light tones', 'detail in mid-tones', and 'depth in shadows', but also 'flat', 'dull', 'faint' and 'pallid'*. Salt prints received an equally mixed response to their *'contrast', 'tonal range', 'not punchy', 'washed up' and 'weaker'*. Inkjet (gloss) had *'contrast too clean'* and carbon-transfer was *'too contrasty'*, though inkjets (matt) and, on occasion, albumens were seen as *'flat'* and photogravures as showing *'lack of contrast', 'faded'* but *'vivid'*.

The affective terms and descriptions of appearance were equally diverse and apparently contradictory. Photogravures were described as *'dreamy, 'inspiring', 'stunning'* and *'sinister'*. Platinum/palladium prints, for example, were *'disturbing', 'freaky', 'gloomy', 'harmful'* but *'enlightened', 'lovely'* and *'spiritual'* though *'unforgiving'*. Inkjets (gloss) were *'professional', 'realistic', 'heavy', 'harsh', but 'lack immediate appeal'* and were *'uninteresting'*. Salt prints were a *'sad, unnatural 'mystery', and carbon-transfers had 'beautiful', 'boring', 'scary' and 'sweaty'* qualities. Given these seriously mixed messages, it is by no means clear whether the object of the participants' observations is the indexicality of the image, pose and presence of the subjects or/and the nature of their realisation in print. These issues are considered more fully in the Discussion section, 7.5 below.

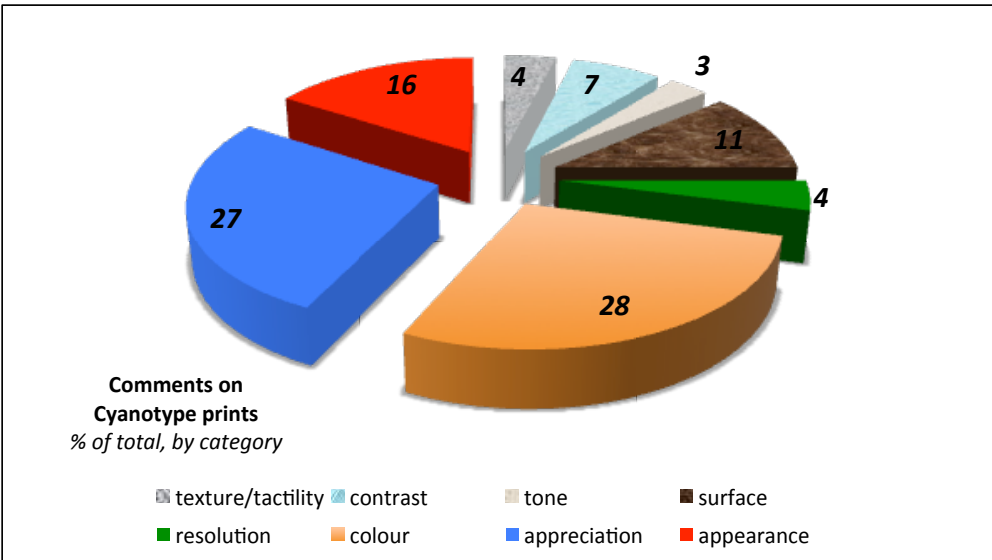
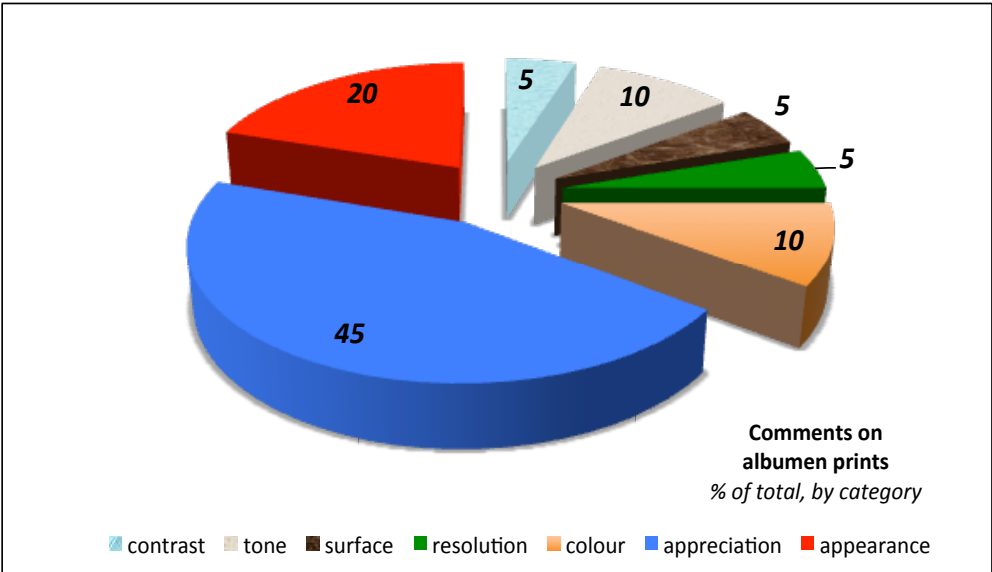
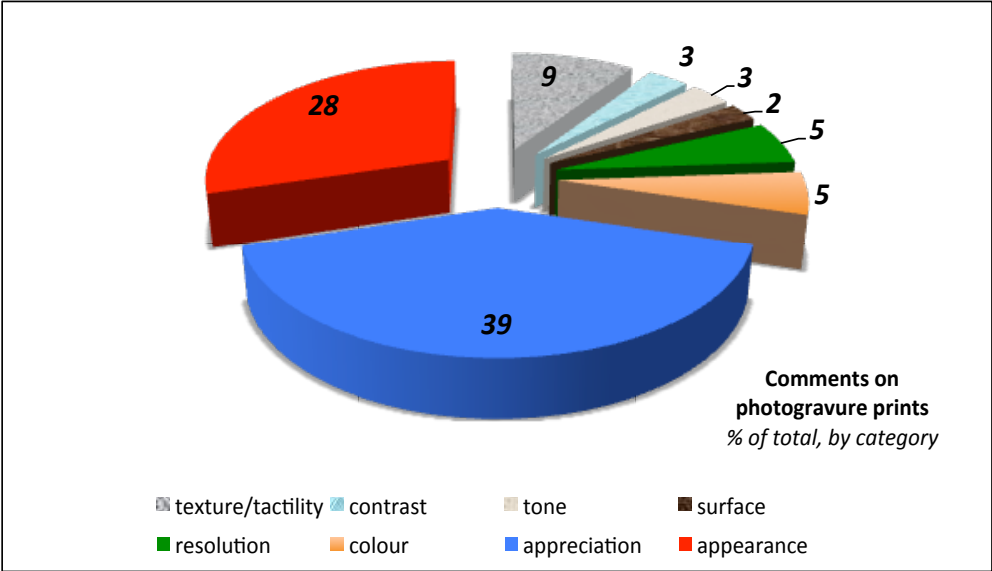


Figure 7.4.2.5

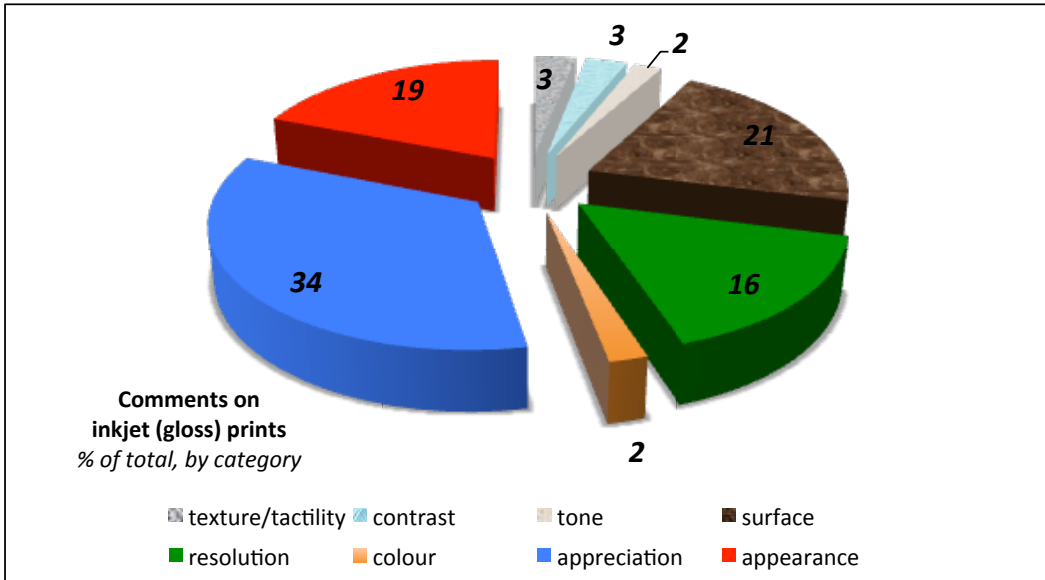
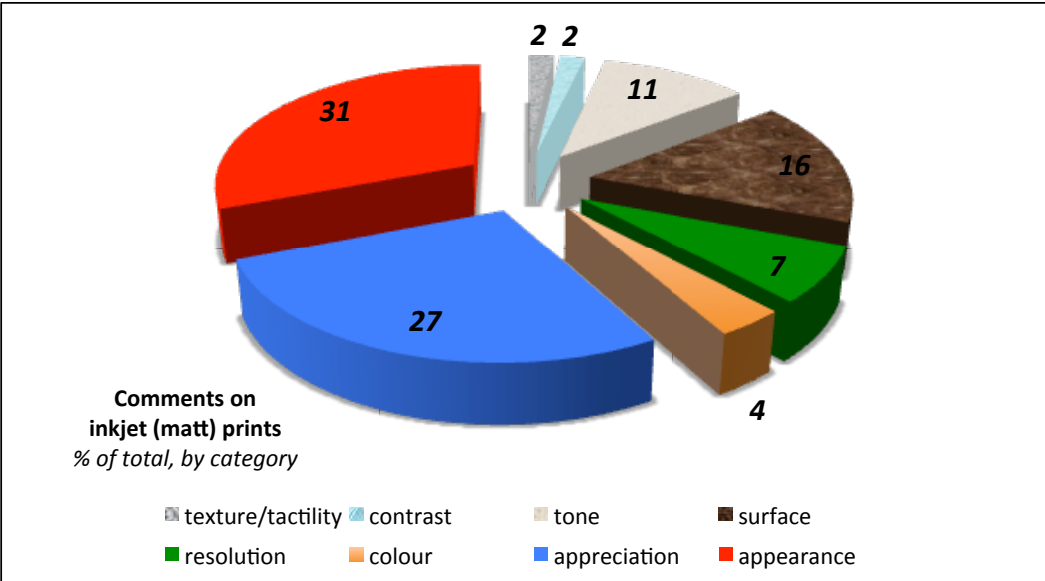
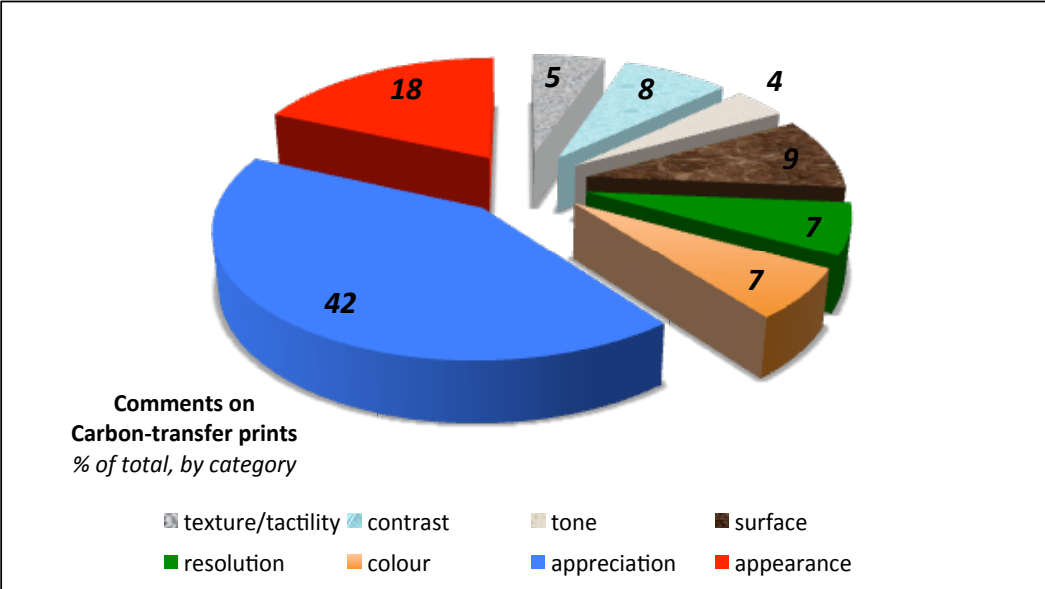


Figure 7.4.2.6

With the exception of the 'blue' cyanotypes, it is not easy to identify print processes simply by their comments, though there are cues in the vocabularies to what might be referred to as archetypal characteristics. For example, *Figure 7.4.2.7*, above, illustrates how 'dark' comments are distributed amongst the different process. Photogravure received 63% of

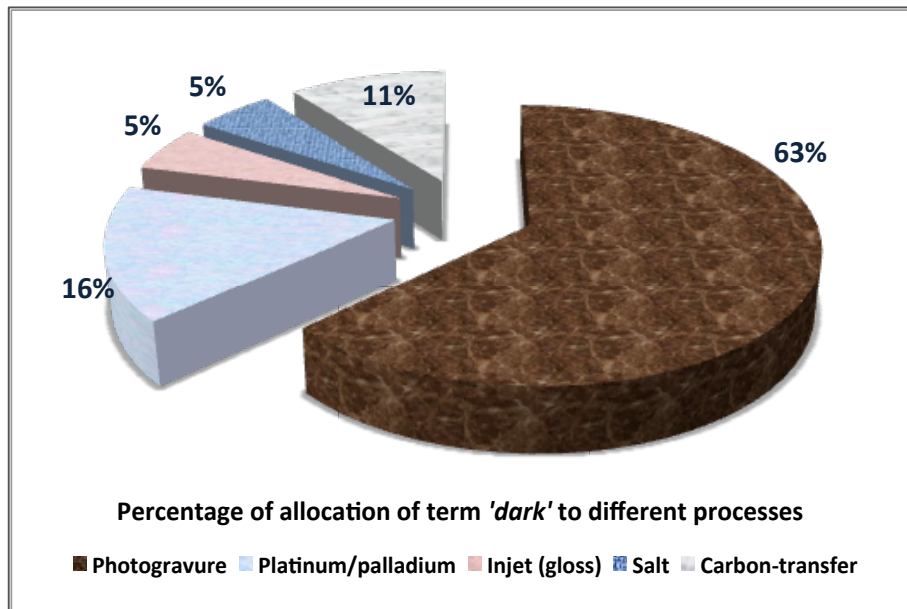


Figure 7.4.2.7

these reference ('caves of dark' for instance), but only 5% of the comments about resolution ('sharp' and 'detail') and predominantly these were not positive. Inkjet (gloss) received the majority of all comments referring to gloss or high shine, and photogravure and platinum over half of all descriptions of warmth and softness. Overall, the profile of descriptions for each process do not conflict with nineteenth century accounts (Duchochois, 1891), but there is sufficient overlap and ambiguity in the vernacular vocabularies for it not to be appropriate to attempt to specify the material attributes of the printing process from their analysis. For similar reasons it has not proven possible to generalise about precisely what each process brings to the realisation of each image, that task requires a further phase of investigation. *Table 7.4.2.8*, below, reports the comments offered by four participants on the different

Table 7.4.2.8

Selected descriptions of tree image – each column’s comments from one participant

Process	Participant A	Participant B	Participant C	Participant D
Platinum-palladium	Sharp, old, nostalgic, waiting for something to happen, some kind of revelation; a secret meeting	Love the depth of the lighter tones	Rich, warm, bright highlights, depth in shadows and lots of detail in mid-tones. Background appears to recede, print has deep perspective and tree appears to project out of the surface of the print	Dreamy, soft, inviting, silver, fairy-tale, detailed, charcoal
Albumen	Fake, too warm, self-conscious	Colour of print not to my taste	Tones are quite strange, warm in some areas and cooler in others. Slight sheen on surface but not distracting like 1D (inkjet). The eye can still penetrate surface and be in the image. Strong sense of perspective especially with branch projecting outward from picture plane	Precise, ancient, India
Carbon-transfer	Warm, gentle, busy	Preferred print, great feeling of depth	Quite alienating, perhaps due to the tones being much cooler than others. But there is a wonderful richness and tonal depth, it really has an appearance of three dimensionality	Harsh, red, disturbing
Inkjet	Happy precise: detailed, a sunny day	Lacks immediate appeal of some of the other prints,	The sheen on the surface interrupts the eye. It’s not as easy to become absorbed in this print. Good tonal range, detail etc., but it’s a bit boring and flat compared to the others. Somehow it lacks character and the surface holds no interest.	Gloss, contrast, glass, slippery, fragile, good-looking, sculpture, body
Cyanotype	Unreal, strange, weak, sad – seeing the gorgeous old tree in the Blue makes me think of death	Least appealing, wrong colour	Blue, flat, water, sea, chalky, matt, bold. Image sunk into surface of paper becomes part of image. Textured but is texture of paper+ medium, not photo. Flattened perspective and loss of fine detail	Blue, old, historical
Salt	Old, timeless, ancient, warm, grainy, rough	Very attractive print ‘finish’	Very strange colours and split tones, slightly distracting. Great depth in perspective and wonderful tonal range especially in tree.	Timeless, sun, animals, tones, variations

process realisations of the image of the tree (Image 1, *Illustration 7.4.1.1* above). These examples show, a not untypical, breadth and variation in observations, made by different participants in respect of the same image and same process. The carbon-transfer print of the tree image is ‘harsh’, ‘red’, and ‘disturbing’ for one observer, but with a ‘wonderful richness and tonal depth’ for another. The same image as a photogravure is ‘scary’, ‘old’, ‘dank’, but ‘like an impressionist picture’ through another set of eyes. It is clear the different processes do effect discernible character on the images they realise, though not with the same valency for each observer or each image.

7.4.3 Shared descriptors – Phases 1 and 2

54 terms from the second phase replicated those reported in Phase 1 (section 7.3 above), and these are shown in *Table 7.4.3.1*, below.

beautiful	definition	grey	quality	strong
bleached	depth	gritty	real	tangible
blue	detail	imperfect	red	texture
brown	disturbing	light	rich	tones
chalky	dull	long time ago	rough	touch
character	earthy	matt	sepia	vigorous
classic	faint	muddled	shadows	warm
clean	flat	mystery	sharp	wet
cold	glossy	old	shiny	yellow
contrast	glow	painterly	smooth	
dark	grainy	precise	soft	

Reflecting the overall balance of comments from the *Phase 2* exercise, over half of these shared terms illustrate affective responses. There is a variety of quite evocative descriptions. ‘Disturbing’ and ‘vigorous’ are not cliché visual terms, and alongside other terms, such as *beautiful*, *painterly*, *strong* and *character*, are indicative of significant affective impression. A smaller proportion of the shared comments reference material attributes of the print surface or qualities of production. Descriptions of print quality, including ‘flat’, ‘sharp’,

'precise', 'tones' and 'contrast', are complemented by observations on print materiality, for example 'texture', 'rough', 'gritty', 'shiny' and 'chalky'. There is significant overlap and complementarity between the vocabularies generated by the two phases. There are no apparent incompatibilities or discrepancies, either in terms of the comments overall or in the descriptions of the different processes. The main differences are evident in the facility for Phase 2 participants to offer more considered and extensive commentaries than the single words responses typical of the 'post-it' records of Phase 1 and the time to reflect on the 'powerful', 'sinister' and 'melancholic' images they were asked to examine.

7.5 Discussion

There have been several psychology studies with associated interest in vernacular vocabularies. Jacobsen *et al.*, (2004) asked German students to identify adjectives used to describe the aesthetics of objects, though without the stimulus presence of artefacts. Two terms offered by the overwhelming majority of respondents were *'schön'* (beautiful) and *'hässlich'* (ugly), which led the researchers to offer *'beautiful-ugly'* as the single core dimension of aesthetic impression. This proposal has not been confirmed. Studies that examined particular types of stimuli and circumstances of viewing indicate that aesthetic impression is education, context and object-type dependent (Leder *et al.*, 2004; Parsons, 1989; Stich *et al.*, 2007). The Dutch study by Augustin *et al.* (2012) evidenced different criteria for different object classes, though *'mooi'* (beautiful) figured prominently within the majority of groups. Istók *et al.* (2009) in their study of vernacular descriptions of response to music, also conducted without aesthetic stimulus, identified 'beautiful' as the single most important criterion, though could find no evidence of a beauty-ugly dimension. Interestingly, they found experienced musicians volunteered different descriptors than lay-people or students.

Related studies of vocabulary generation have been undertaken with respect to tactile feeling (Chen & Chuang, 2014; Djonov & Van Leeuwen, 2011; Gallace & Spence, 2011; Jansson-Boyd & Marlow, 2007) and textures (Bhushan *et al.*, 1997; Lui *et al.*, 2015). These studies share common methodological underpinnings: the collection of descriptive terms generated by experimental volunteers and their statistical analysis for saliency (Sutrop, 2001) in order to develop clusters or dimensions of aesthetic impression. The dimensions derived by expert or lay-panel assignment of the terms, or by statistical analyses, then are tested for mutual exclusivity and term inclusion. 'Despite the tremendous variety in the words we have to describe textures, there is an underlying structure to the lexical space which can be derived from the experimental data' (Bhushan *et al.*, 1997: 219). These investigations variously reference theories of aesthetic perception (Bullot & Reber, 2013; Leder *et al.*, 2004; Parson, 1989) that acknowledge individual and cultural experience as participant factors. However, the commonly reported objective and outcome is a lexicon structured as clusters or dimensions with little explicit cultural contextualisation. Analytic and experimental approaches of this nature are mirrored by studies that seek to locate the aesthetic in attributes of the artefact rather than the semantic structures of the viewer (Calabria & Fairchild, 2003; Khan & Vogel, 2012; Pederson *et al.*, 2011), presented also as psychological not cultural phenomena.

Whilst I seek to situate my explorations of photographic language and meaning (Chapter Three) and the development of my professional practice (Chapter Four) within a cultural and experiential environment, the lexicon generated in Phases 1 and 2 is presented with no cultural contextualisation. The circumscribed remit and primary objectives of these initial phases were to explore how respondents describe prints, and whether, and in what regard, the material performances and presentations of the images had resonance for the viewer. The main purpose was to examine evidence regarding the aesthetic saliency of print process

attributes, not to identify the psychological structuring of the lexicon of aesthetic response, or to construct an affective hierarchy of artefact attributes.

In this regard, there is persuasive evidence here. Firstly, that participants were aware of and responded to the materiality of the photographic works presented to them and, secondly, that photographic printing processes, judged by the lexicon volunteered, can elicit a broad variety of affective and evaluative response, sometimes quite powerfully so. Whether, it's early wet-chemistry technique or digital technology, materiality is evidently noticeable and describable. How the materiality matters, in the sense of whether the attributes identified by the vernacular lexicon differentially affect participants' appreciation of the images in a consistent manner, and what the aesthetic or cognitive effect are of each attribute, remain open issues.

To provide a context for such potential future investigations, the lexicon from *Phases 1* and *2* were reviewed against the dimensional paradigm of Axelsson (2011: 15) referred to in Section 7.1, above. Axelsson posited a five axis framework to model the main factors he argued were significant in shaping aesthetic appreciation, namely: hedonic tone, expressiveness, interest, uncertainty and dynamic. The first two dimensions refer directly to the attributes of the stimulus, print artefact in this case, whilst the third, fourth and fifth acknowledge the prior experience and cultural capital informing the respondents' engagement with the artefact – the later proposals of Bullock & Reber (2013) are not dissimilar in this regard. Axelsson's five broad dimension are formed from five series of continua (2011:

22) that are proposed to encompass discrete elements of aesthetic response, shown again in Table 7.5.1, below. Where the valency is clear, aspects of the lexicon combined from *Phases 1 & 2* map conveniently to the hedonic and expressive continua. However, many of the evaluations of the prints' material attributes, lack of contrast and sharpness for example, have no immediate situation in this model unless their reference is mediated by respondents'

Dimension	Continua
Hedonic Tone	Pleasant ↔ Unpleasant
	Harmonious ↔ Disharmonious
	Tasteful ↔ Tasteless
	Comfortable ↔ Uncomfortable
	Appealing ↔ Repulsive
Expressiveness	Expressive ↔ Expressionless
	Full of feeling ↔ Without feeling
	Soulful ↔ Soulless
	Significant ↔ Insignificant
	Full of life ↔ Lifeless
Interesting-Uninteresting	Familiar ↔ Unfamiliar
	Common ↔ Rare
	Expected ↔ Unexpected
	Comprehensible ↔ Incomprehensible
Uncertainty	Simple ↔ Complex
	Without contradictions ↔ Full of contradictions
	Unambiguous ↔ Ambiguous
	Enigmatic ↔ Obvious
Dynamic	Dynamic ↔ Static
	Eventful ↔ Uneventful
	Lively ↔ Quiet
	Active ↔ Passive
Adapted from Axelsson (2011)	

Figure 7.5.1 (repeated from 7.1.1)

prior experience, including cultural inscription of the qualities of “the good photograph”. So lack of contrast and sharpness, to continue the example, may have aesthetic effect because they trespass against expectations. What is clear, from this brief comparison with Axelsson’s model, is that the lexicon from this research evidences the saliency of the materiality and process of the print, but in its present form suggests further investigation would be productive.

‘Semantic-differential’ scales record reactions to presented stimuli – for example, words, images, tastes, sounds or commercial products – in terms of ratings on bipolar scales defined with contrasting, preferably antonymic, descriptors at either pole of the continua (Heise, 1970). The scales, shown in *Table 7.5.2* below, were constructed from over one hundred of the respondents’ descriptors that could be represented and re-structured as bipolar continua. As an instrument it is unwieldy to implement because of its unedited size, it requires revision to minimise duplication whilst retaining discrimination, before possible use in any future exercise. Nevertheless, it provides a useful illustration and summary of breadth, imagination and pertinence of the lexicon generated by the participants, and evidence of the material-syntax of the print processes.

Table 7.5.2
Semantic differential: potential bipolar scales
 Developed from Phase 1 & Phase 2 responses

alienating	unifying	bleached	unbleached
ambivalent	certain	blurry	sharp
anxious	calm	chalk	soot
arresting	boring	clean	grubby
artificial	real	clear	veiled
attractive	unattractive	coarse	refined
authentic	inauthentic	dense	thin
beautiful	ugly	dimensional	undimensional
bright	dark	distinct	indistinct
calming	exciting	dull	bright
characterful	insipid	dusty	clean
classical	modern	faded	vivid
cold	warm	flowing	static
convincing	unconvincing	foggy	clear
dated	contemporar	fuzzy	clear
dead	alive	glossy	matt
disturbing	reassuring	good detail	poor detail
dramatic	undramatic	grainy	smooth
dreamy	alert	gritty	polished
dying	lively	harsh	soft
edgy	safe	imperfect	perfect
emotional	unemotional	layered	flattened
enjoyable	unenjoyable	livid	palid
eye-catching	non-descript	luminous	murky
gloomy	lively	lustrous	leaden
good	bad	manipulated	unmanipulated
harmony	disharmony	messy	tidy
heavy	light	muddy	clear
human	Inhuman	not punchy	punchy
inspiring	uninspiring	overexposed	under
intimate	distant	painterly	photographic

Table 7.5.2
Semantic differential: potential bipolar scales
 Developed from Phase 1 & Phase 2 responses

inviting	uninviting		perspective	shallow
lovely	unlovely		photocopy	original
melancholy	happy		precise	imprecise
mild	strong		reflective	non-reflective
moody	cheerful		robust	delicate
mystery	evident		rough	smooth
nice	not nice		shadowy	light
old fashioned	fashionable		shiny	matt
organic	inorganic		textured	untextured
outstanding	mediocre		luminous	murky
plush	meagre		lustrous	leaden
potent	ineffective		manipulated	unmanipulated
powerful	weak		messy	tidy
preferred	not preferred		muddy	clear
professional	unprofession		not punchy	punchy
pure	impure		overexposed	under
scary	not scary		painterly	photographic
safe	challenging		perspective	shallow
thoughtful	not		photocopy	original
unappealing	appealing		precise	imprecise
uninteresting	intriguing		reflective	non-reflective
			robust	delicate
			rough	smooth
			shadowy	light
			shiny	matt

7.6 Summary

In total, over 300 discrete terms were offered by respondents as descriptors of, and responses to, the print artefacts they examined. They included what might be referred to as ‘standard’ photographic concepts – contrast, blur, grain, for example – but the majority of terms were clearly the creative deployment of the respondents’ imaginative evaluation. There was no evident reluctance or inability, on their part, to relate to the materiality of the prints; on the contrary, the richness of the lexicon is a strong indication of the potency of the artefact *qua* artefact to provoke engagement and narrative. I have not attempted through factor analysis to isolate any key or specific material attributes of prints, or types of print process, that may in some way correlate with ‘aesthetic response’. I do not seek to establish that a ‘matt’ surface is aesthetic whilst ‘glossy’ is not, or that platinum print highlights are

aesthetically '*subtle*' and '*delicate*' whilst cyanotypes' are not. I believe, rather, that I have established that viewers have at their intellectual and affective disposal sophisticated modes of discernment and narrative production, and that, should they so choose, they can respond fully to the tactile, textural and more general sensory experience of the print as well as to the design, composition and content of the image it articulates.

I have found no persuasive evidence that viewers 'prefer' one type of print process over another, though respondents were (deliberately) not asked that question. But their responses do indicate that they were well aware of the distinctive nature of the surfaces and the tonal discriminations, for example, produced by the different processes, and were self-consciously alert to the mediation of appreciation they evoked. In short, it seems reasonable to conclude that materiality matters.

Chapter Eight – The ‘aura of the alchemy’¹

‘Materiality is of key importance here because materiality precisely emphasizes the relational qualities of photographs in a social context’.

Elizabeth Edwards (2009: 33)

The framework for the research was set out in an initial chapter on methodology, Chapter Two, in Chapter Three on interpretations of the status and meanings of photographs, and Chapter Four (and Appendix) on representations of the body and the skin. Chapter Five (and its Appendix) described the nineteenth century contact-printing processes adopted for this project and considered how digital technologies may be adapted for use to manage and optimise desirable print properties. These quantitative trials were reported in Chapter Six (and its Appendix) and informed the production of the works for exhibition. In Chapter Seven (and Appendix), Response Group exercises recorded an extensive vernacular lexicon of viewers’ affective responses and their descriptions of the material and reproductive quality of prints prepared through a variety of contact-printing processes.

This final chapter reflects on new knowledge developed through this research project, summarising the findings and issues presented by the empirical evaluations and vernacular descriptions of ‘early-process’ photographic contact-prints, and considers possible avenues for further investigation. In conclusion, it introduces the practice-based works offered for exhibition.

8.1 The research – an overview

The measurements of print attributes and the vernacular lexicon of their descriptions, summarised and reviewed below, and the development of my professional practice,

¹ Alan Trachtenberg (1989: 13)

take their relevance from the cultural environs in which pictures are rendered meaningful. In Chapter Three, I considered analyses of visual communication and the syntax or 'language' of photography to provide a theoretical context for my investigations into the aesthetic salience of print materiality. I did not find theories of pictorial language (Floch, 2000; Lindekens, 1976) directly productive for my research because their conceptualisations (Saint-Martin, 1990) privilege image content and design over the *objectness* of the artefact. Issues of physicality, though, are recognised within visual semioticians' articulation that 'any system of signs is carried by a material medium which has its own principles of structure' (Hodge & Tripp, 1986: 17) and its own cultural significations and connotations (Barthes, 1997). Each medium is 'charged with cultural signification', each has its own 'affordances' and 'constraints' and its materialities offer their own semiotic interest, becoming a field for 'further segmentation' (Eco, 1976: 267). Parallel enquiries into the syntax of prints (Crawford, 1979; Jussim, 1983) note that production is contained in, but not determined by, its technical parameters, within which autographic opportunities remain open. The material resources for these opportunities – surface, resolution, colour, gloss, contrast, paper-weight in the case of photographic printing for example – are culturally inflected signifiers (Kress & Van Leeuwen, 2006) available for authorial exploitation.

Also in Chapter Three, I argued that claims for the automaticity of photography, and for the implacable indexicality and transparency of photographs, pay insufficient regard to its essentially performative and relational process (Adams, 1983; Edwards, 2009; Phillips, 2009). Photographs do not stand *sui generis* in the world. Photography requires, for its audience, a quartet performance: by the photographer and subject in the manufacture of the original negative or digital file; by the printmaker or engineer in the realisation of the image; by the publisher's contextualisation of the viewing; and by ascriptive and systemic signifying cultural

relationships with the photograph as a physical (or virtual) object. The relative significance of materiality's aesthetic potency can be weighed as an element in the context of the embrace of this whole interpretative cosmos. Nevertheless, materiality is a potential signifying resource available for the maker, culturally inflected and, as the vocabularies of Chapter Seven illustrate, holding evident resonance for the viewer.

8.1.1 Practice-led research – the contribution of digital technology

Historically, all photographic contact-printing processes required the use of analogue negatives – initially paper based, followed by the introduction of wet and then dry glass-plates before, in turn, they were superseded in the 1890s by flexible film which, with various incremental improvements in quality and sensitivity, remained the basis of 'fine art' and commercial print production for over a century (Gernsheim, 1988; Newhall, 1982). Two characteristics of negative/positive analogue printing were of particular relevance to my enquiries. Firstly, the density-range of the negative – its scale of increasing opacity to ultraviolet radiation, from shadow areas to highlights – must individually be tailored to the characteristics of the contact printing process. Analogue negatives for carbon transfer, platinum/palladium and salt printing require a more extended density range than, say, those for cyanotype or polymer-gravure printing. Analogue negatives are, therefore, print-process specific, and this must be planned into the performance of the initial photograph and its exposure and development. Secondly, contact-printing requires negatives of the same size as the intended print. In analogue practice, this means that the final prints are limited to the operating size of the camera – be it 'half-plate', 'whole-plate', medium or large format – unless bigger film negatives are created by re-photographed (twice) enlargement.

The use of digital technologies to produce negatives, commonly through inkjet printing on acetate substrates, eliminates the print size restrictions (assuming original digital files of

appropriate pixel dimensions) as current software programs can accomplish cropping and alterations in image file dimensions whilst maintaining and even improving sharpness of focus, line definition, noise control and tonal differentiation. My results (Chapter Six and its Appendix, and the Exhibition of works) indicate that inkjet printed digital negatives are capable of producing contact-prints across a range of 'early processes' with acceptable visual qualities. Given the speed and ease with which digital inkjet negatives can be produced, the enhanced portfolio of techniques for practitioners is beneficial, avoiding completely the wet-chemistry darkroom requirement for film enlargements.

There are additional benefits also available to the practitioner from the incorporation of digital technologies, as they provide for significantly greater latitude in the exposure and production of the original image and allow inkjet negatives to be tailored to size and to the photo-sensitivities of a range of contact-printing processes whilst minimising image degradation which may arise from excessive digital manipulations. The results from my experiments so indicating were set out in Chapter Six and its Appendix.

Whilst the use of colourised inkjet negatives has been practised since the late 1990s (Burkholder, 1999), my adoption of selected wavelength-specific UV sources, including lamps and LED arrays, in combination with specific negative colours selected to exploit the specific wavelength photo-sensitivities of the chemistry of each process is, I believe, a novel development. One which may be used to enhance authorial direction in the production of contact-prints with more controlled tonal differentiation, in particular with processes such as photopolymer gravure and cyanotype that necessitate 'short-scale' tonal transparencies for their exposure.

8.1.2 Practice-led research – material saliency

Chapter Six, and its Appendix, described the measured material characteristics of prints produced using a range of photographic contact processes. The attributes selected included, for example, tonal density reflectance range (the darkness of the shadow areas compared with the brightness of the highlights), surface texture, glossiness, image granularity/smoothness and resolution (image sharpness). The measurements were taken using calibrated instruments or industry standard procedures. Allowing for variations effected by different paper stock, these quantitative descriptions were consistent across the processes in confirming that higher surface gloss (reflectance) is associated with enhanced tonal differential in the shadows and highlights and higher contrast within the image. Other things being equal, processes where the photosensitive chemistry, or ink in the case of photogravure, were absorbed into the surface fibres and the body of the substrate – cyanotype, salt and platinum, for example – produced prints with lower gloss reflectance, density range, acutance and smoothness than was the case with processes such as carbon-transfer and albumen where the image is formed on rather than within the print surface. Reports (Phase 2 respondents) of the visual inspection, side by side, of types of prints generally were consonant with the measured characteristics. However, assessments (Phase 1) made where the other processes using the same images were not available for immediate comparison produced more ‘favourable’ ratings for the ‘in-surface’ prints, for example, for the tonal differentiation achieved with platinum prints and for the maximum print density and acutance of gravures.

This research project did not seek to identify a unique profile of material attributes for each type of printing process. It was not designed to correlate particular material attributes with differential valencies of aesthetic impression, nor to categorise or rank their saliency. The project’s intention, in this regard, was more limited and more open: to ask viewers to

describe in their own words what they saw, and to examine those vocabularies for inferential indications of cognitive and affective engagement with the materiality of the prints. The evidence from Phase 1 and Phase 2 participants here is clear: materiality matters, it is noticed, it is described and it informs aesthetic response. The commentaries, reported in Chapter Seven, provide a very rich and extensive vocabulary of empirical and affective descriptors. Respondents could distinguish, and provide words for many aspects of the material attributes and reproduction qualities of the prints. Their choice of words indicates this – ‘*definition*’, ‘*blue*’, ‘*grainy*’ and ‘*textured*’ for example. Certain generalities can be identified in regard to these descriptors. Many respondents were sensitive to tonal range and contrast, to resolution (acutance or sharpness), and to graininess/granularity. Their descriptors, though, were frequently applied as critiques of absence – prints were ‘*flat*’, ‘*dull*’, ‘*soft*’, ‘*gloomy*’. There were ‘positive’ terms for resolution, ‘*sharp*’, ‘*detailed*’ and ‘*precise*’ for instance, and for gloss and surface shine, but very few for contrast and tonal range. What might be called the ‘reproduction qualities’ were more often commented on when their absence was noted, rather than their presence endorsed.

There was greater fluency and imagination with affective responses. ‘*Warm*’, for example, was not unexpected, neither was ‘*cold*’, but ‘*disturbing*’, ‘*dramatic*’, ‘*death*’, ‘*forceful*’, ‘*mean*’, ‘*disgusting*’, ‘*mournful*’, ‘*rooted*’, ‘*rich*’, ‘*optimistic*’ and ‘*yuck*’ suggest a real strength of affective contact with those particular realisations of the images. These terms are relational, expressive of a ‘sense-making’, ‘narrative-seeking’ experiential engagement – witness ‘*subtle*’, ‘*powerful*’, ‘*snazzy*’, ‘*rich*’, ‘*miserable*’, ‘*wonky*’, ‘*electric*’, ‘*cool*’. Though care was taken not to inform Phase 2 respondents of the nature or names of the print processes, the forms in which my prints were presented to the respondents as objects of interest – monochrome, sepia (in the main), original works on paper – clearly offered rich cultural connotation. Judging by some of the descriptors volunteered – ‘*ancient*’, ‘*Victorian*’,

'renaissance', 'painterly', 'old fashioned', 'classic', 'enlightened' – the historical motif of early process printing, with its *'archaic'* and *pictorialist* connotations resonated with some of the observers and were articulated in their commentaries. Similarly, the contemporary connotations of the inkjet prints informed their descriptions – *'bright', 'gloss', 'shiny', 'sharp', 'modern', 'straight printing'*.

In terms of process discriminators, platinum/palladium prints were often, but not invariably, reported to be materially different, from cyanotypes or salt prints for instance. Gravures were easily distinguished from inkjet prints, carbon-transfer from salt. The feel – haptic vision and tactility – of each type of print appeared distinctive, and was so reported, but the distinctions noted varied from image to image and from observer to observer. Photogravures and platinum/palladium prints were spoken of *'warmly'* and frequently in respect of the *'deep', 'rich', 'velvet, 'lovely' 'depths'* of their blacks and shadows, although by machine measurement the carbon-transfer and inkjet prints have markedly longer tonal scales and greater contrasts. Cyanotypes evoked some widespread unease about their colour and surface texture – *'sad', 'unrealistic', 'utterly inappropriate colour', 'over-processed'* – but many affective positives, *'suited image well', 'painterly', 'wonderful tones', 'beautiful'*. Few comments were offered that gainsaid conventional wisdom about the appearance of the processes, but such was the variation in the valency of descriptors of each process, by image, and such was the variation in terms offered by each respondent of each image, by process, that no categorical visual definition of any particular process emerged. In one sense, given the inevitable variation of the production values of the prints across the series, this is unsurprising. *'Considerations of materiality do not require that specific meanings be assigned to various materials in that we do not need to make absolute determinations about specific materials'* meaning. And yet materials do significantly inform the content of

contemporary art' (Mitchell, 2009: iii). From the point of view of a maker seeking to exploit the full material possibilities of contact-printing, this might be said to be encouraging.

These responses to the materialities of the prints appear, at least in part, independently of image content – that is, they arise from the nature of the process and presentation, not solely from the subject of the picture. There is evidence here, well known to professional artists, that the physical performance of the print provides potential for an affective engagement for the viewer. How that plays with the information and content of the image is a separate and, in respect of my research, still an open issue, but I believe it is clear that the specific materiality of the print – its channel, *sememe* or syntax, its physical construction and embodiment – presents an evocation affectively performed with its audience. However, it takes an inductive leap from observing that the performance of the print has significant aesthetic and emotional potential to 'explaining' how those mechanisms operate. The engagement must be neurologically and psychologically processed 'internally' in some manner, but I emphasise the theoretical trope that individual behaviour is culturally inscribed and interpreted and expressed within a social environment. Any neurological or psychological account that overlooks this is incomplete for my interest. It is cultural relationship that is articulated by the print's viewer, and accounts that overlook this miss something of the subtlety, power and richness of aesthetic experience.

8.1.3 Practice-based research – the development of personal works

The outcomes from both the quantitative and qualitative practice-led strands of the research have strongly influenced the development of my photography and printmaking. Explorations of the performance of digital colourised negatives under different UV sources provided enhanced authorial control over tonal differentiation and, particularly in the production of a 'short density-range' process such as polymer photogravure, reduced the evidence of digital

artefacts and image degradation (Chapter Six). The breadth and imagination of the vernacular lexicon offered by respondents in Phase 1 and Phase 2 of the research (Chapter Seven) demonstrated the aesthetic salience of the material and reproductive qualities of early-process prints, and viewers' capacities for nuanced and subtle appreciation of the physicality of what they are looking at. Materiality clearly matters and is, as a richly 'signifying resource', connotative well beyond the archaisms of the sepia picture. The reported vocabularies evidence the aesthetic potential of process and viewers' sensitivity and discrimination, jointly indicative of an expressive portfolio of print-making techniques. My exhibition of works, an integral element of the project, is informed by the empirical research to illustrate the saliency, and something of the breadth, of this portfolio – and, on the basis of its theoretical contextualisation, to articulate cultural formations of body and skin through an affective corporeal presence and a resonant sensory experience of the materiality of the artefact.

In Chapter Four and its Appendix, I considered aspects of theorisations on portraiture and on the inscription of meaning on the skin and the body. A common theme emerged, of relevance to this research and my production of works. Photography, whatever the automacity of its processes, provides no objective access to an '*it-has-been*' reality (Barthes, 2002). Participants themselves, and the frame of their engagement at the original photographic event, together with the photographer's and printmaker's sense of the craft and purpose of their process and the viewers' inference of meaning, are cultural formations, articulations and appreciations (Costello *et al.*, 2012; Grundberg, 2004; Long, 2009; Roberts, 1998; Schilling, 2003). The indexicality/denotation of photography may be the necessary condition of its vernacular appreciation, but it is not sufficient as a simple statement of signification to encompass either the social structuration of its signs or their cognitive and affective cultural connotation (Kress & Van Leeuwen, 2006). In this regard, contemporary

visual media have been evident agencies both in the discursive shaping and maintenance of identity and value and, particularly situated with the body and the skin, in their contestations (Basting, 1998; Belting, 2001; Butler, 1990; Friedan, 2006; Lawrence, 1994; Laqueur, 1990).

Exhibitions of photographs of the aged body enjoyed a relatively brief flowering a decade or so ago, in indirect accompaniment to the critical theory and sociological interrogations of 'ageism' and the production and inscription of the social differences through which it was maintained (Browne, 1998; Katz, 1996; Pearsall, 1997). Visual interrogations have followed critiques, for example, of gender formation, by making the invisible body manifest and foregrounding skin as a preferred site of statement. 'Embodiment' is a central issue for my professional practice, offering the body and the skin as a site of experience rather than primarily a deconstruction. Iris Cleaver and Willemijn Ruberg note that, 'social and discursive constructionist approaches to the body have been very influential, but have also come under attack, due to their presumed lack of attention to individual corporeal experience, which is often taken to mean a neglect of agency' (2014: 550). They go on to comment,

'Unlike unreflective essentialism that presupposes that certain aspects of the human condition necessarily lie outside history and culture, and unlike unreflective constructivism that presupposes that no aspect of the human condition lies outside history and culture, the self-reflexive preoccupation of the 'corporealists' (or the 'neo-essentialists') is the un-predetermined boundary between the two' (Cleaver & Ruberg, 2014: 599).

Michael Fried (2008) writes of the ways in which contemporary photography transcends a key dichotomy – that of the subject/actor's 'absorption' or 'theatricality'. Every act of portrayal requires the artist/photographer to construct, physically or imaginatively, a tableau where the actors, drawn or photographed from the life, are co-actively complicit in the posing they strike and the knowingness they exhibit of being observed and of the making and anticipated viewing of the image. In what Fried calls *absorption*, the sitters/actors are presented, indicated by diverted gaze and preoccupation with other activities, as apparently

unaware that they are participating in a social and artistic construction. It is now not uncommon, a development that Fried applauds, for these 'fictions' to be made explicit.

Such a 'self-reflexive' and 'explicit' stance underpins my works. In my practice I wish, with my subjects, to find opportunities in photographic performance to privilege a dual appreciation of the corporeal: experiential engagement with the physicality and agency of both the other and therefore one's self, but effected within the evident context of its cultural formation and construction. My sitters are complicit in the production and demonstration of their bodies, their skins, and the forms of their presence, but through the materialities of the print are articulated also as corporeal engagement and affectation.

The Exhibition pieces, obviously, will 'stand-as-they-stand' for each viewer's sentient appreciation and narrative. As maker, they realise for me – through *disegno*, material and the sitters' gifts of openness – something of the presence, not merely the representation, of the sitter. These printing processes, gravure especially, can provide for more than photographic particularity. They do not diminish the persona to indexical reproduction, but offer the physicality of imprint – an imago landscape of humanity and experience, that is timeless.

Photographs of the prints selected for exhibition are reproduced in the Appendix to this Chapter.

8.2 Contribution to new knowledge

The four main aims of this project were set out in the opening chapter and these are repeated below:

- Aim 1. To consider discourse on the production of meaning – syntax and language – in photographic images, with specific reference to the contribution of surface and materiality, situating the research within a historical and cultural contextual overview of representations of the skin, body and person.
- Aim 2. Based upon quantitative assessments of print properties, to investigate the incorporation of contemporary digital technologies with 19th and early 20th century photographic processes in order to secure the enhancement of print surface, tonality and opportunities for authorial gesture.
- Aim 3. To explore viewers' aesthetic appreciation of the materiality of prints produced using selected nineteenth century photographic contact-printing processes
- Aim 4. To produce an exhibition of photographic prints that explores the aesthetics of surface, texture and tonality in the representation of skin, body and person, in the main using older subjects.

In summary, in respect of Aim 1 the research developed a twofold contribution to new knowledge. Firstly, noting the relative disregard of the photograph as object, I contextualised and considered the contribution of photographic 'print surface and materialities' as an integral aspect of the production of 'photographic meaning', that embraced cross-disciplinary discourse: psychology, photography theory, semiotics, cultural studies, communication theory, visual studies and phenomenology. I hypothesised that viewers' cognitive and affective appreciations are shaped by the 'performance' or realisation of the image as print, or screen display, and that its material articulation has aesthetic salience. Secondly, the research contextualised and described the affective contribution of the 'skin of the print' and its haptic properties within multi-disciplinary discourse on representations of the skin, the body and the persona.

In respect of Aim 2, the research produced empirical evidence of the digital contribution to early contact-printing processes. In particular, the measurement of:

- the print reflectance and surface gloss produced on ten paper substrates using six contact-printing processes
- the ultraviolet wavelength absorption of Epson Ultrachrome K3 inkjet inks and their relationships with the particular photo-sensitivities of early photographic contact-printing chemistries
- the relationships between UV lamp emission spectra, UV opacity of inkjet negatives and resulting print reflectance densities of six early contact-printing processes, and the identification of 'anomalous' results.

Adapting the work of previous investigators (Burkholder, 1999; Koch-Schulte, 2007; Nelson, *n.d.*; Reeder, 2007), I developed practical techniques to identify inkjet negative colourisations providing effective UV opacity that minimised the image file digital 'degradation' required to secure 'linearisation' and 'calibration' and optimised print mottle and noise.

Again in summary, in respect of Aim 3 the research recorded a vernacular lexicon of print descriptors and aesthetic responses and demonstrated the active role of the viewer in the construction of aesthetic response and in the saliency of the prints' material potentialities. It reported the relationship between print processes and vernacular description and demonstrated that materiality and surface attributes are salient to viewers' aesthetic appreciation of prints and that there appeared no invariant relationship between print attribute and viewer response. The research demonstrated that the formulation of viewers' narratives of image 'meaning' was informed by print materiality.

With regard to Aim 4, in the context of the digital contributions developed under Aim 2 and the vernacular lexicon recorded under Aim 3, the practice-based strands of the research were

realised in new works that articulated the potential of print materialities and surface through the representation of the skin and the form and presence of the aged body. The choice of different early contact-printing processes allowed their haptic properties to be deployed selectively and creatively as testament to the sitters' tangible physicality and monumentality, a non-idealised affirmation and acceptance of our common corporeality.

8.3 Further research

The broad range of enquiries followed in this project provided for the empirical investigations and personal practice to be situated theoretically, historically and culturally. This contextualisation has served to indicate avenues for further exploration. There is additional 'practical' research to be done. I have not undertaken tests with other proprietary inkjet inks and acetate substrates to be able to demonstrate similarity of effects with other products. I propose at some stage to undertake these. I also intend to produce prototype UV arrays containing switchable series of wavelength specific LEDs in order that one exposure unit may be used that is capable of adjustment to match the sensitivities of different processes. There is the prospect that switchable UV arrays will provide tonal and contrast control of early printing processes that is analogous to that obtained with multi-grade silver gelatine papers. Whilst there is a wealth of practitioner experience with pre- and post-process surface treatments such as glazing and waxing – such treatments can significantly affect the surface texture and materiality of prints – there are few reports of systematic comparisons and evaluations. Similarly, practitioner experience with different substrates is rarely shared, and then usually anecdotally, and there are opportunities here also for structured and controlled experimentation on their effects on print materiality.

Perhaps more theoretically interesting, are the relationships between print materiality and the interpretative narratives developed by viewers in their construction of image meaning.

This research project focused upon the aesthetic saliency of the print artefact for viewers' responses. It became clear from the vernacular descriptions provided by response group members that they were seeking to '*make sense*' of the images in front of them. The materiality of the prints helped to shaped these narratives and, reciprocally, their narratives informed responses to the artefactual properties. The relationship between the properties of the print-object and the viewer's appreciation is subtle and complex and would benefit from interrogation. The circumstances and situation of display of the prints, not considered in this project, potentially provide significant interpretative '*cues*' to the viewer and, in a more comprehensive account of materiality, would need to be examined further. The outcomes of the current project offer "proof of concept" of the saliency of print materiality, but do not fully articulate the fluid and interpretative constructions of affective and cognitive engagement. More listening to viewers talk about what they see is called for.

8.4 Afterword

Photographic alchemists, scientists and artists of the nineteenth century bequeathed a cornucopia of imagery, process, technique and vision that continues to inform and provoke practitioners and theorists. Their work can shine with an aura polished not merely by the nostalgia of scarcity and age, but through their '*imago*' – the imprint of what-has-been – and the resonance of their handcrafted productions. Whilst contemporary technologies provide virtually instant image capture, manipulation, transmission and replication undreamt of in photography's infancy, early practitioners enjoyed a portfolio of more physical material effects and authorial interventions that some now seek to recover. The autographic performance of photographic materiality, beyond the practice of hobbyists and Sunday

photographers, has recognised artistic authenticity and invigorated commercial value, as Damien Hirst's photogravures illustrate.

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Appendix to Chapter Four

Portrayal – mimesis and its abnegation

'Most artists of the last one hundred years.. have abandoned the veil of appearances, through which there is shown a hidden reality which has since become dim, and are now trying to show us the invisible interplay of relations between the body and the universe within which it evolves...Classical art believed that the form came from inside – hence the need to study anatomy. [Modern] art is built on the opposite idea: form is the result of the pressures exerted by the milieu...'

Phillippe Comar (1995: 439).

The cultural convention that portraits present the selfhood or ontological identity of the sitter is historically contingent and of relatively recent origin. In this Appendix, I consider selfhood and its portrayal to provide a broad context for the discussion in Chapter Four on the representation of the skin and the body. I examine aspects of the notion of personal identity, and how its subjectivity and social placement may be portrayed.

Representation in some form is obviously the *sine qua non* of portraiture, but the achievement of 'recognisability', the celebration of social position and the revelation of inner character, have over time all been very fluid artistic requirements. Shearer West writes,

'Portraits are not just likenesses but works of art that engage with ideas of identity as they are perceived, represented, and understood in different times and places. 'Identity' can encompass the character, personality, social standing relationships, profession, age and gender of the portrait subject. These qualities are not fixed but are expressive of the expectations and circumstances of the time the portrait was made' (West, 2004: 11).

Portraits present, and are read by audiences, within historicised cultural conventions of perception and representation (West, 2004; Woodall, 1997). Based upon the *idée fixe* that formal and physiognomic indicators correlate with character and moral worth, a presumption maintained in western cultures for over six hundred years, portraiture has come both to reflect and inscribe psychologies of identity and intercourse.

After the Classical period, fascination with selfhood and individuality in representation appears only to have begun fully to emerge in Europe in the fourteenth and early fifteenth centuries. Representation through facial or physical resemblance was uncommon in early medieval practice, where identity and social position (if not simply assumed as a consequence of commission or place of display) were more likely to be indicated through elaboration of heraldic codes or related accretions (Perkinson, 2007: 136). Initially heavily reliant on expressive gesture and attitude of the body rather than the features of the face, the represented identity indicated the state of grace and standing of the individual soul. Hans Belting records that veristic likenesses existed alongside more symbolic representation for some time before assuming pre-eminence. What was gradually lost in the process was *imago*, the incarnation of the secular subject in, or rather as, the artefact (Belting, 1994). In many sacred productions and religious relics this sense of presence remains highly valued. Brigitte Miriam Bedos-Rezak (2011: 170), in her study of medieval seals and charter documents refers to the twelfth century's 'anthropomorphic turn', as the formula of representation changed from the allegorical to the mimetic.

'It was as an imprint, the seal, that the image first emerged within the field of social praxis. Once there, the imprinted *imago* evolved further, into a replica. Each of these formulas, mirror, imprint, replica, intersected and interacted with definitions of the person, and of identity, ultimately producing a practice of representation which, in turn, reciprocally affected the body social and the world of images' (Bedos-Rezak, 2011: 171).

History illuminates current practice here, for the photograph clearly is the contemporary *imago*, the imprinted – albeit frequently electronic – index or incarnation metaphorically stamped with more than the physical impression of its referent. A 'magic not an art', in Barthes' words (2002: 76).

By the end of the fourteenth century the face had taken on a 'vital locus of meaning' and was becoming the primary site for the mimetic display and veneration of individuality (Perkinson,

2007: 135). Renaissance images were intended to imply more than was being shown. 'We see a higher, spiritual inwardness in external form...the apparent sitter in a Renaissance portrait was thus an external appearance showing an inward truth' (Summers, 1987: 110). Portraiture 'came into its own' (Schneider 2002: 22) between the late medieval period, through the Renaissance and into the seventeenth century. The mimetic depiction of the unique appearance of a particular person became the distinguishing characteristic of European portraiture.

Its complexity revealed in its rhetorical gesture, in its vast vocabulary of physical postures and facial expressions and in the range of emblems and other attributes characterising the sitters and symbolising their spheres of influence' (Schneider, 2002: 6).

There was unprecedented development and innovation of portrait style and new forms evolved, complementing and perhaps provoking early modern conceptualisation of individuality and selfhood. Portraitists came to pay attention to their sitters' inner states and moral attitudes as well as their worldly attainments. Erwin Panofsky is clear about what he sees as the dichotomous nature of portraiture.

'A portrait aims by definition at two essentials...On the one hand it seeks to bring out whatever it is in which the sitter differs from the rest of humanity.. On the other hand it seeks to bring out whatever the sitter has in common with the rest of humanity and what remained in him regardless of the place and time'. (Panofsky, 1955: 194).

Not only was the work to show appropriate presentational setting, postural iconography and classical reference, not only was the veracity of the external likeness to be evident and flattering in some degree, but the artist was obliged to reveal a particularity of character and celebrate an inner-morality. The social and economic location of the sitter open to depiction through a wide range of stylistic and indexical devices such as the inclusion of props and backgrounds (Berenson, 1948: 199). However, the moral character of the subject, a separate and perhaps conflicting dimension, is not quite so straightforward to convey; artist, patron and audience must share a common symbolic and referential vocabulary.

In painted portraits, there is a long tradition of formal neutral countenance and demeanour, sitters have not commonly been described through strong facial expression. Other indicators therefore, accoutrement and posture in particular, have been important. Rosenberg confirms, 'The history of portraiture is a gallery of poses, an array of types and styles which codifies the assumptions, biases, and aspirations of the society' (Rosenberg, 1976: 90). Each and every aspect and aesthetic element of the portrait contribute to signification. First and perhaps foremost, the milieu within which the contractual engagement is positioned provides the paradigmatic arena within which the expectations and understandings of sponsor, author and audience meet. Modes of *authorial execution* are determined within this philosophical and social context, for example: through choice of medium and scale of presentation; the iconography of accoutrements, setting and pose; the verisimilitude of the likeness, realistic or idealised; whether the orientation of the work is towards the depiction of the external character of the subject and his/her place within the world, or to the internal, to the personal identity, the moral and psychological character or soul. Woodall writes, 'portraits are filled with the external signs of a person's socialised self, what Erving Goffman referred to as the front of an individual'. Interpretation became predicated upon a 'symptomatic relationship between external appearance and an invisible, internal self which was the ultimate subject of interest' (Woodall, 1997: 7).

Until speculative productions for the gallery became more common, patrons and their artists consistently held that portraiture required the making of a recognisable likeness of an identifiable subject. Within the fashion and expectation of the day, latitude was allowed in respect of the degree of mimetic fidelity and in regard to the manner of presentation, pose, circumstance and accoutrement, but the underpinning discipline had long been accepted – portraits must exhibit aspects of resemblance or depiction of the persona or corporeality of their subject sufficient to acknowledge unique identity and social placement. With the

mimetic fidelity of photography, it was the acceptability not accuracy of likeness that could be problematic. The common early photographic style of portraiture, though in part due to the requirements of lengthy exposures, was formal, almost monumentalised, informed by the style and dignity of the earlier classical painted portraits. It celebrated status, authenticating and externalising experience. *Illustration A4.1*, below, offers examples from the very early in photographic development. This formality was largely maintained even as the emerging technologies allowed for more spontaneous activity and pose.



Three Girls
Gustav Oehme (daguerreotype) 1845



Mrs Elizabeth Hall, Newhaven
Hill & Adamson 1845 (salt print)

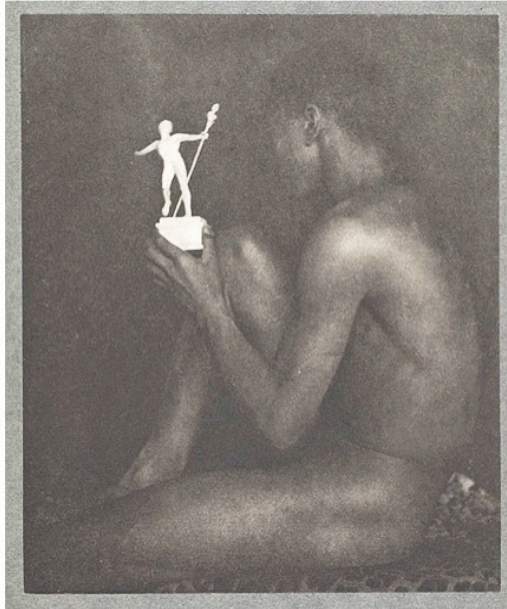
Illustration A4.1

Commenting in 1921 on the Salon des Indépendants, Fernand Léger recognised three groups of exhibiting artists – the sub-impressionists, the Cubists and the delightfully named *Sunday Painters* (Fer, 1994: 6). Contemporary critics proposed alternatives. Maurice Raynal, for example, recognised only Realists and Idealists according to whether the painting was based upon a naturalistic rendering of observed forms or whether the artist ‘lifted his art above

nature' producing an 'autonomous composition born of the artist's imagination' (Fer, 1994: 7). Raynal's dichotomy has a certain applicability to the photographic world. There are photographers who seek to represent the 'world without' in all its beauty, banality, pathos or tragedy, and there are those who seem to represent in some way an inner world, selecting and abstracting to present inner, perhaps universal meanings – an associated articulation of the 'hard' versus 'soft' debate.

At the end of the nineteenth century and for much of the first decade of the twentieth, *Pictorialism* was the only movement of note acknowledged by the photographic art-world. Much of the movement's work was symbolic and highly romantic with an emphasis on dark and moody lighting and the use of elaborate darkroom and printing techniques often heavily retouched or printed in combination. For any aspirant practitioner to be acknowledged as other than mere artisan, the 'art', as opposed to craft, of photography required heavily manipulated, soft focus, expressive renditions of, say, 'spring awakening', 'moonlight', 'autumn', 'the faun' or 'the shadow of death' (for example, *Illustration A4.2* below). Considering the radicalism of the then contemporary developments in painting, the loyalty shown by so many photographers at this time to the conventions of the *ancien régime* is telling. Lenses, portable cameras, plate and roll film developments were available to support 'straight photography' and 'precisionism' well before these new movements became established. Ian Jeffrey (1981) notes 'gradually the ties between Art, Nature, Truth and Beauty were loosened...photographers would never again work under the guidance of such a coherent and authoritative ideology as that which dominated the 1890s -1910s'.

Though photographers of the 'Futurist', 'Dadaist' and 'Surrealist' schools later made up for lost opportunities, the failure of photography early to engage artistically and energetically with the issues facing western industrialising and modernising nations contrasts remarkably



'Ebony and Ivory' 1895
Photogravure
Holland Day



'Etude' 1895
Photogravure
Demachy

Illustration A4.2

with the fertile response from painters and sculptors to changing social and industrial conditions. The provocation of photography appears to have diluted the obligation for 'realistic' representation by artists in other media. Whilst traditional patronised portraiture continued in the cultural rear-guard, photography fermented the rapid subversion of the French academic salons and their Ingresian idealisations. The status of naturalistic portraiture was undermined, as Woodall makes clear,

'the advent of photography implicitly challenged and problematised portraiture's claim to absolute truth... Physiognomic interpretation was predicated upon a symptomatic relationship between external appearance and an invisible, internal self which was the ultimate subject of interest... twentieth century rejection of figurative imagery challenged the belief that visual resemblance to a living or once-living model is necessary or appropriate to the representation of identity' (Woodall, 1997: 7).

The powerful and continuing reaction against quasi-photographic representation left mimetic painted portraiture distinctly unappealing to the artist-elite, a response maintained until very recent revivals of 'photo-realistic' practice. Comar (1995: 39) writes that 'The art

of the past century has presented an increasingly chaotic, derisory image of man...crushed, deliberately subjective’.

‘Some will not recognize the truthfulness of my mirror. Let them remember that I am not here to reflect the surface (this can be done by the photographic plate), but must penetrate inside. My mirror probes down to the heart. I write words on the forehead and around the corners of the mouth. My human faces are truer than the real ones’. Paul Klee (republished 1964: 47).

‘I know that my idea of portraiture came from dissatisfaction with portraits that resembled people. I would wish my portraits to be of the people, not like them’. Lucian Freud, (quoted in Lambert, 1993: 12).

These declarations attributed to Klee and Freud at opposite ends of the last century endorse, indeed they celebrate, the revelatory possibilities and purpose of portraiture but, clearly, at the disregard of mimetic fidelity. In contrast, the development of art-photography between the 1940s and 1980s initially appears a more subdued, less flamboyant affair. Walker Evans, Eugene Smith, Robert Frank, Bill Brandt and Cartier-Bresson amongst others, offered by comparison quieter though highly expressive documentary oeuvres. Not perhaps until William Eggleston introduced colour images to the gallery and museum market and Warhol’s photo-screen prints was there anything approaching the abruptness that marked the changes of earlier epochs. What originally allowed photography, for the first time in the 1970s and 80s, to be admitted into the high-art fold was its use by non-photographer artists to document their creative activities, happenings and performances and when photographers begin in a ‘knowing’ way to interrogate notions of personal presentation and social identity - usually by concealing it. Cindy Sherman’s imaginary film stills and Gillian Wearing’s masks for example. Photographers offered photographs as ‘ready-mades’ or *object-trouvés* or ‘simple snaps’ – witness Tillmans’ *‘If one thing matters everything matters’*. Earlier, in the work for example of Arbus, Winograd and Weegee, people had been exposed as curiosities, if not freaks, raising issues around the complicity of the audience; loosening the fiction that sitters are unknowing or indifferent to the act of photography, indifferent to

the social and economic fact that their picture, their representation, had been commandeered for display and exploitation.

One of the benefits of making and viewing photographic portraits is that the inner voyeur is legitimised, close scrutiny can take place avoiding any necessity to manage the social interaction that merely looking at another person invariably demands. It's a powerful attraction and, *pace* Susan Sontag (1979), as the language of 'shot', 'capture' and 'take' make clear, a power relation also. Outside surveillance or street photography, every act of portrayal requires the artist-photographer to construct, physically or virtually, a tableau where the actors, drawn or photographed from the life, are complicit in the posing they strike and the knowingness they demonstrate both of being observed and of the making and anticipated viewing of the image. There has been a recent fashion in art-photography for these fictions to be made explicit – the sitter, perhaps, staring directly and frontally out of the image, without expression, showing full acknowledgement that the photographer is/has been director of its manufacture, there right in front, and will, in course, be replaced by the viewers' interrogation. Jeff Wall's image, *'Picture for Women'*, for example, and Thomas Ruff's 'passport' portraits, make this absolutely explicit. Leo Steinberg (1972) writes that avant-garde production presents a continual 'sacrifice' of the qualities of its predecessors, a 'shrinkage' or subtraction, to which the previous generation of artists strongly objects. Julian Stallabrass offers a rationale for the disparagement of individual agency,

'The tradition of expressive, committed documentary exemplified by W. Eugene Smith and more recently Sebastião Salgado...is assumed, from the point of view of the art-world sophisticate, to embody social naïveté and cultural simplicity.' (Stallabrass, 2007: 73).

The contemporary critical climate has encouraged curators, dealers and commentators to privilege work that makes explicit the constructed, 'non-realist' nature of the art-photography enterprise. Common devices adopted to achieve this include: allowing the subject to make explicit the 'coercion' and power relations of the photographic act; including

the photographer in the act of pressing the shutter release in the image; composing an overtly constructed tableau to deny empathetic association; and finessing the clichéd or banal composition by signalling (or conspicuously not signalling) the author's intention to parody. Documentary and other earlier photographic traditions were predicated on recordable truth-to-reality presented for the beholder to decode. As John Roberts explains, 'Following (the earlier) Barthes, a semiological-structuralist model argued for the ideological positioning of the spectator, representation did not reflect the world but constructed our view of it' (Roberts. 1998: 148).

In consequence, incorporation and re-interpretation was a legitimate tool of production. 'One of the most powerful ideas taken from Barthes and other thinkers concerned the futility of originality. Since mass-media photography was replete with messages, new pictures were not needed. In part or in full, existing images could be appropriated and re-exhibited' (Warner, 2002: 423). Post-modern photographic productions foreground clever asides, witty puns and references, eclectic combinations that satirise through their alienation or anomie – work that self-consciously addresses its own representational status. 'There is no place in the postmodern world for a belief in the authenticity of experience, in the sanctity of the individual artist's vision, in genius, or originality' (Grundberg, 2004: 17).

In portraiture of a postmodern perspective, particularly photographic, there is a denial of the existential authenticity of the subject and a dependence upon complicit audience appreciation of the ontological insecurity of social role, identity and performativity – being in on the 'joke' is a simple but seductive, pleasure. Jane Tormey describes this anti-aesthetic.

'In avoiding the extraordinary and the transcendent, we achieve a provocative banal. Photographs apparently created in an artificial manner reveal the natural... The current anti-aesthetic has assumed the unremarkable and the awful as 'good' (Tormey, 2007: 29).

The *real* she says, 'need no longer be elevated or made beautiful and much recent work has embraced this absence by deliberately looking chaotic and uncalculated or distinctly banal – to the point of being super-banal' (2007: 35). Practices that foreground the semiotics and mechanisms of cultural production, can appear to render art as stylised albeit frequently spectacular parody, self-referentially forgoing creative political generation. They restrict access to the creativity and transformational power of narrative and other aesthetic artistic traditions, critiquing both vernacular and previous practice. It is an interesting conjunction.

Jonathon Long writes, that the assertion of the need,

'..to interpret and understand the workings of the image in its social context, to unmask the ideological and political power of images, and draw on what we can term the 'hermeneutics of suspicion' developed by Barthes and others in the 1950s and 1960s [takes place] at precisely the same moment that Barthes himself begins to take photographs out of the realm of the social, the political and the ideological, and place them squarely in the realm of the individual, the subjective and the idiosyncratic' (Long, 2009: 32).

These developments in the writings of the 'later' Barthes, particularly in *Camera Lucida* (Barthes, 1981) are welcomed by Paul Crowther (2009: 140) as an implicit recognition of the insights offered by phenomenological philosophy. Barthes' conceptualisations of 'intertextuality' and the 'death of the author' in his earlier work foregrounded the historical acquisition and distribution of the patterns of signification and the social codes through which they were expressed (Barthes, 1977). Representation does not reflect the world, but constructs our view of it. It is Crowther's argument that this paradigm appreciates the art object only as an effect of the signs through which it is articulated. However, in '*Camera Lucida*', although he doesn't use the term, Barthes acknowledges the unique character of photography as *imago*.

'Realists do not take the photograph for a 'copy' of reality, but for an emanation of past reality: a magic, not an art. To ask whether a photograph is analogical or coded is not a good means of analysis. The important thing is that the photograph possesses an evidential force, and that its testimony bears not on the object but on time. From a phenomenological viewpoint, in the photograph, the power of authentication exceeds the power of representation' (Barthes, 2002: 76).

The aspiration of phenomenological ontology is to understand the objects of the world by means of an examination of the way they present themselves to consciousness. To explore the photographic image, phenomenologically, is to 'explore how photographs present themselves to consciousness, and to reveal their nature by careful description of what they are for us in experience' (Friday, 2005: 340). For Barthes in 'Camera Lucida' the photograph is testimony to the '*that-has-been*' character of the object, to its prior existence at some time. He refers to the photograph's embodiment and articulation of 'intractable reality' in its attainment of its own kind of 'ecstasy' (Barthes, 2002: 119). Crowther (2009: 5) re-interprets this as testimony to the photograph's *phenomenological depth* and as an acknowledgement of the *intrinsic significance* of the material existence of the print – an incarnation, of the moment, if not of the subject.

Contemporary postmodern critique, though, is uncomfortable with the notion of an authentic, autonomous self, and suspicious of the idea that the cultural inscription and ascription of personality and character can be represented through portraiture. Ernst Van Alphen writes, 'the project of "portraying somebody in her/his individual originality or quality of essence" has come to an end' (Van Alphen, 1997: 254). Buchlock is more emphatic, 'the tradition of representation of the individual subject is obsolete. There is practically no credible portrait painting any more, except for Warhol's portraits which are of course a total perversion of the idea' (Buchlock, 2003: 251). Van Alphen, though, holds open the possibility, if not of rebirth, then at least re-interpretation of ambition, 'portraiture as a genre has become the form of new conceptions of subjectivity and new notions of representation' (1997: 255). It is not just the portrayal of the individual that is critiqued. The Cartesian dualism of the Enlightenment - the rational, self-conscious mind within a subject body - has been severely criticised by postmodern denials of the very possibility of coherent agentic individuality. Foucault provides an account,

'My objective... has been to create a history of the different modes by which in our culture human beings are made subjects... It is a form of power which makes individuals subjects. There are two meanings of the word subject: subject to someone else's control and dependence, and tied to his own identity by a conscience and self-knowledge. Both meanings suggest a form of power which subjugates and makes subject to' (quoted in Dreyfus & Rabinow, 1982: 208).

Not all theorists draw the pessimistic conclusion that the sphere of independent action and the authenticity of the representation of individual experience are thereby entirely lost. Notable amongst others, Kobena Mercer (1994) and Judith Butler (1999) allow radicalising potential to the articulation of the subjective experience of oppression – black and female, in these cases – that may appear marginalised by postmodern accounts. Other authors, David Dudrick (2005) for example, find Foucault's analyses leaves open the prospect of authentic ontological independence for the subject.

Put very schematically, in analyses of the 'work' done by the photographic image in the formation and representation of selfhood, discourse privileging both the hegemonic formation of cultural production and the structuring of signification are available. Within these paradigms, the image – as an artefact - is regarded as immaterial. Paradoxically, whilst current theoretic interrogations might have questioned the mimetic credentials of portraiture, destabilising the self as a consistent enduring entity in the process, its commercial life has seldom been stronger. Outside of 'celebrity' magazines, there may be fewer works of highly idealised or sycophantic presentation, the settings may be informal rather than classical, and the styles of production more idiosyncratic, but for public tribute, celebration and affection the demand for portraits is as active if not as aggressive as ever. The explosion of vernacular works – *selfies*, *Facebook* entries, *instagrams*, for example - outstrips completely the appetite within the parallel universe of the fine-art market for those 'new conceptions of subjectivity' and novelties of representation.

Appendix to Chapter Five

Section A5 – Introduction

Section A5.1 outlines the development of contact-printing processes.

Section A5.2 outlines the printing processes employed for this project.

Section A5.3 provides further information about the *Phase A* empirical assessment of selected processes with selected paper stocks.

A5 – Introduction

Two powerful imperatives appear to have driven ‘improvements’ of nineteenth and twentieth century commercial and artistic printmaking in Europe and North America. Firstly, the search for enhanced mimetic depiction to secure two-dimensional printed representation visually ‘more faithful’ to the image or scene of origin. Secondly, the achievement of reductions in operating costs through increases in the speed, mechanisation and reliability of production, a trend evident since the end of the seventeenth century. The commercial direction of these innovations has been consistent – movements away from the minimalism of outline and flatness of form towards the ‘realism’ of volume and tonal distinction, and from monochrome towards the more ‘realistic’ representation of colour. A characteristic potential of photography is the comprehensive reproduction of fine distinctions and smoothly continuous gradations of tone, showing no artificial discontinuities or posterisation. In many instances, the disjunctures of gradated tone in photographic analogue negatives are visible only at the microscopic if not molecular level. Except in the case of the clumped grain of pushed film development, photographic prints can exhibit both smoothness of gradated change and also a precision or abruptness of tonal edge transition – known as acutance or definition – that are not easily achievable by other technologies of tonal reproduction.

What photographic printing processes do not provide, however, is any easy facility to strengthen image composition through simplification and emphasis of line or form. It's difficult to image, for example, photographic versions of Dürer's woodcut scenarios carrying anything approaching the same distillation of meaning and moral. Photographic prints, solarisation notwithstanding, cannot create or define the abstracted line-edge of forms. They depict and delineate only through tonal gradation and every element of the image or site of origination is included equally. Authorial intention is realised in origination, for example, by the construction of the scene, differential focus, exposure, field of view or choice of lens or chemistry, not by line-inscribed boundaries of form and mass or the exclusion of unnecessary detail. It is articulated, or performed, as print through the careful choice and manipulation of the process and materiality of production. The challenge to photography's status as fine (representational) art, as Patrick Maynard describes it, is deciding whether enough of the image is there on purpose - the extent, with reference to purposive actions rather than natural events, to which one can ask of it "why is that there?" (Maynard, 2007: 118).

With etched or engraved prints, the authorial intention and contribution is evident. The production of the print necessitated – by hand, eye and interpretation - the translation of an original idea, drawing or image and its excavation upon the body of the printing plate. These modes of translation demonstrate an identifiable '*syntax*' of expression and execution, each period or school working within their own styles and techniques of transposition and visual communication (Ivins, 1953). In comparison, whilst most photographic printing requires transposition – from negative or digital file to positive media if nothing else – the manual translation of each and every line is impossible, hence Ivins' claim that the processes were without syntax. The various modes of the making of photographs and their subsequent realisation as pictures in print or on screen, however, cannot be reduced merely to 'mind

independent' automatic optical/mechanical/chemical or electronic processes. Their manufacture necessitates authorial mediation, selection and management and the expressions of such interventions are culturally shaped and interpreted. In other words, the making and viewing of photographs inevitably is subject to contemporary cultural conventions of visual appreciation and understanding. Witness the 'progression' of photographic schools: pictorialism, straight photography, *neue sachlichkeit*, conceptual and post-modern for example. Whilst the underpinning 'cultural tastes' and structurations lack the formal and consistent articulation and discipline of true linguistic syntactical rules, nevertheless in general they demonstrate reciprocity of comprehension between maker and viewer sufficient to bind closely the expression and the appreciation of authorial visual intent and purpose.

A5.1 Technological and cultural development

For much of the seventeenth and eighteenth centuries, copyist engravers and etchers sought to enhance their replication of painted tonal gradation and dimensionality of form. In turn, nineteenth century photographic printers sought for the longevity of the intaglio or relief prints, the speed of lithograph production, and the authority and colours of paint to combine with the fine detail and resolution of the daguerreotype. Though the syntax of optics had been well understood for some time, through the *camera lucida* for instance, Louis Daguerre's process in the late 1830s offered a genuinely innovative chemical methodology providing previously unparalleled and apparently permanent fidelity of detail and image resolution (Daguerre, 1839). It was incorporated almost seamlessly into the cultural and economic milieu and modes of presentation of the painted or silhouette miniature, rapidly displacing their production.

The making of images by photochemical methods preceded the invention of camera photography by almost twenty years. Nicéphore Niépce succeeded in making rather crude intaglio plates by exposing bitumen-coated plates to the sun under oiled copies of line engravings (Newhall, 1982). An incentive here was financial as engraved or etched plates took many weeks by skilled craftsmen to produce and the trade in Europe and America was growing exponentially to meet the increasing demand for illustrated papers and journals and for prints. But neither the technologies of Niépce nor Daguerre were commercially successful as printmaking media, despite the innovations later explored by Donn , Berres and Fizeau in etching and electrotyping daguerreotype plates (Wright, 2004: 21). For some considerable period, at least until the early 1870s, photography lacked the means to provide for wide-scale manufacture and distribution of its images. Caroline Bloore notes that ‘photography failed to attract the recognition that it deserved and the revolutionary nature of the invention as a printmaking medium went largely unrecognised’ (Bloore, 1991: 67).

Unlike Daguerreotypes, Fox Talbot’s *calotype*¹ paper negatives could be reproduced as multiple positive prints, he successfully published several part-works, but each copy of each image had to be individually exposed – weather dependant of course - and processed. Relatively unskilled and cheaper labour, compared with that necessary for engraving, etching or lithography, was used and the expense and time involved in the making of the plate was avoided, but overall, taking production difficulties into account, the unit costs of the photographic and relief or engraving/etching processes were not dissimilar (Bloore, 1991: 89). Major problems were experienced with the atmospheric degradation of photographic prints. Talbot’s publications offered replacements where necessary, and each print required ‘tipping-in’ as an individual insertion because photographic prints could not be frame

¹ The calotype process developed by Fox Talbot was the first ‘developing-out’ process which greatly increase the sensitivity of the early silver-sensitised in-camera paper negatives, and hence reduced the time taken for exposures.

reproduced alongside relief-printed text. In consequence, the predominant demand for photographs was for small-scale productions: *carte de visite*, tintypes and small edition calotype and later albumen prints – Hill & Adamson, for instance, and Peach-Robinson were favourite authors. In terms of larger-scale productions, the illustrations most commonly and widely distributed would have been relief prints, possibly prepared with the assistance of photographic images developed on wood blocks, or lithographic stones.

During the late eighteenth and for the first half of the nineteenth century, printmaking moved beyond the earlier predominantly linear syntax, and tonal representations became increasingly sophisticated through the use of etches, aquatints, mezzotints and lithographs. The use of techniques such as electrotyping and steel facing meant that large print runs could cheaply be managed for popular titles and the reproduction of famous paintings. However, whilst the mass circulation of photographs was unknown, an emerging proto-photographic aesthetic, in terms of image detail and mimetic fidelity, and inferred objectivity, became an increasingly fashionable characteristic of printmaking and illustrated publication.

Once the techniques became available, photography began to be used to effect authenticity in reportage. Bloore writes, 'guides and travel books began to use engravings after photographs instead of engravings from sketches. Most of these wood engraved illustrations demonstrated their photographic origins in a variety of ways. Extreme detail began to appear on the facades of buildings or on rock-strewn hillsides. Foreground detail became less picturesque' (Bloore, 1991). Such influence, of course, operates reciprocally. As photography sought to be accepted as an alternative printmaking method, practitioners claimed kinship with earlier processes, engraving or mezzotint for example. As late as the 1850s Philip Delamotte was publicising his photographs as 'beautiful mezzotint engravings, with the superior accuracy which sun painting must ensure' (Notes & Queries, 1853: 420). Francis Bedford's studio portraits were described as 'sharp and vivid, but so soft and delicate

withal, that they look like exquisite engravings' (Pritchard, 1882: 10). Bloore writes, 'In 1840 there was no such thing as a photographic print-buying public; by the end of the 1860s photography provided a serious challenge to other printmaking processes... between the 1840s and the 1860s photographic prints had developed styles and markets of their own' (Bloore, 1991: 361).

The key to the growing cultural prominence of photography was the adoption of printing techniques that did not rely on environmentally susceptible silver chemistries. As Helena Wright notes, 'it was necessary to find a way to print photographs mechanically, that is, with permanent, non-fading printer's ink from one matrix, in a format compatible with typographic printing, and to eliminate the need for mounting' (Wright, 2004: 24). The 1859 award of the Duc-de-Luynes' prizes for print permanence stimulated the development of dichromated colloidal and iron-based processes and led, in relatively short innovative order, to the commercial adoption of platinum, carbon-tissue transfer, photogravure, Woodburytype and collotype processes, all sharing the use of the high definition glass-plate collodion negative.

Platinum prints exhibit a delicacy and tonal distinction in print highlights that still today informs our sense of the potential expressiveness of photography. Platinum prints are permanent, non-fading and, unlike silver prints, are little affected by atmospheric pollutants, but they can only with difficulty be mass-produced as they require individual exposure and tipping-in. Carbon-tissue prints are constructed by the transfer of a matrix of sensitised and exposed pigmented gelatine, they are stable and permanent and can exhibit great depth and density of colour. Because the images sit upon rather than within the fabric of the substrate, they can exhibit high definition, genuine continuous tone and – with the right negative – a level of fine detail approaching that of the daguerreotype. As a simple transfer process, however, carbon prints require individual exposure and processing, they are not easily mass-

produced. Wright notes, 'the carbon process produced rich, dark images, full of sharp detail and very suitable for images of cathedrals, sculpture and paintings. However, it was slow and very labour intensive, not the universally applicable, reproductive method so keenly sought'. Walter Woodbury attempted to resolve these drawbacks by the manufacture of lead moulds from the exposed and developed relief matrix (Wright, 2004: 24). By the injection of hot pigmented-gelatine into the moulds under pressure in contact with a paper substrate, multiple copies could be produced on an assembly line basis. Woodburytype prints are much admired still today for their permanence, tonal distinction, pigmented colour and definition. Standing very slightly proud of the paper's surface, the prints present a smooth, matt surface of some distinction. However, the process could not print text in the same frame as each print required individual tipping-in if the final publication was to be bound, limiting its commercial viability once halftone dot printing was developed.

Gelatine matrices proved a very fertile ground for experimentation, they could be pigmented, photosensitised, exposed and developed through the washing away of the unhardened parts. Paul Pretsch was able to electrotype the matrix and print both intaglio and relief. Charles Nègre produced beautiful large *heliogravure* plates of Chartres Cathedral. Poitevan and Lemerrier and, separately, Pouncy introduced tonal photo-lithographic printing. In the late 1860s, Joseph Albert proved that the photosensitised coating of bichromated gelatine itself, with proper support, could be inked and printed like a lithograph (Newhall, 1982). 'The reticulated grain of the gelatine captured the finest gradations of lights and darks' (Wright, 2004:31). Known as the *collotype*, a single plate was able to print up to two thousand impressions. Before the halftone screen was introduced it provided the fastest, cheapest and most faithful tonal reproduction. Collotypes were in production for fine-art printing well into the twentieth century and there are still some printmakers in Japan and Germany who are practising the process today.

Modelled on the use by etchers of aquatint grain, Fox Talbot's explorations with fabric photographic screens to protect the shadow areas on photogravures were extremely fruitful, informing the development of both Klíc's intaglio and the later *halftone* relief processes. By means of an exposure against a screen of finely inscribed cross-lines, the halftone technology provided for the articulation of a continuous tone image as a matrix on a printing plate of raised dots whose distribution and size precisely mapped the light and shadows of the original. Karl Klíc, building on Fox Talbot's very early photoglyptic screening techniques, developed the aquatint-grained photogravure intaglio process by the transfer of sensitised and exposed gelatine matrices to copper plates as etching resists. The essentials of this technology formed the basis of commercial photogravure illustration printing for much of the next hundred years and remains in use by artist printmakers, though photosensitive polymer plates that take sequential double exposure of stochastic screen and positive transparency are a common replacement for the gelatine matrix on aquatinted copper. This is the technique of preference for much of my professional practice.

Frederic Ives in the United States and also the Levy brothers brought the halftone system, where image and type were finally united in the relief printing block, through to commercial production in the 1880s and 1890s, very quickly displacing the wood engraved reproduction. For a decade or more after its introduction, the screened halftone block frequently required improvement by hand or even overprinting by woodblock. The reproductive codes of the early systems were obtrusive, lacking the smooth linearity and familiarity of the wood block, the evidence of the halftone dot and the coarseness of the screening grids had to be overlooked as viewers learned to read and appreciate the syntax. Wright notes, 'coarse and grainy at first, these primitive experiments could not compare with the tonal superiority of collotype, Woodburytype and photogravure, but their speed and cheapness of execution, together with their letterpress compatibility, drove continuing improvements that made

them acceptable, and finally dominant, before the turn of the twentieth century' (Wright, 2004:34). This dominance, in terms of the mass circulation and accessibility of images, cannot be underestimated either in terms of its commercial or cultural hegemony. The halftone print was for over a century *the medium, the syntax*, for the published performance of photographic imagery. Aside from domestic collections of vernacular snaps and the occasional specialist gravure or collotype publication or salon, halftone or *process* prints in newspapers, magazines and books were the only way the photograph was realised and publically viewed. The halftone experience, in effect, became the photograph. Gary Beegan writes,

Cultural expectations had changed since the 1840s, and faithfulness to the original, rather than translation and interpretation, had become the new standard for reproduction.. The photograph became the criterion for effective reproduction. Just as the photograph was seen as an authorless and unmediated trace of external reality, photographic processes of reproduction were promoted as direct channels of communication in which the hand had been excised (Began, 2008: 187).

Earlier and traditional modes of print reproduction displayed variable and individual character of syntax. The engraved plates of the painting or photograph were not facsimiles; they were acknowledged as stylised interpretations, translations rather than imitations (Gilmour 1978: 8). The original works of etchers – aquatint, soft and hard ground, drypoint – offered languages of expression, hand crafted. They offered an art of communication not merely an act of information. Engraving and etching require selection of focus in their manufacture for not every scenic detail can be included. A hierarchy of attention and compositional status must be articulated. This is not easily the case with the all embracing and all-inclusive lens of the camera which is democratic and indifferent in its treatment of everything that is visible before it. The halftone is by no means without a syntax of manufacture, but seductive in its apparent realism it privileges a uni-dimensional narrative of content over the compound materiality of presentation. In all modes since its emergence,

photography has been criticised as mechanistic and soulless but, perhaps exacerbating such aesthetic antipathy, the halftone process achieved a disembodiment, a dematerialisation, which leaves the image present but somehow without relation to any single physical existence or manifestation. It is a hegemony complemented by growing contemporary preferences for on-screen rather than printed display. Kevin Hass writes,

‘Perhaps the most obvious connection between photography and printmaking is through the halftone process and the commercial forms of printing that utilize it. The ability to accurately reproduce and disseminate photographs through this process is perhaps one of the most important inventions in printing since moveable type. We know the world not through actual photographs, but through printed reproductions of photographs’ (Hass, 2006: 2).

With the exception of a very few processes producing unique objects – daguerreotype, ambrotype and tintype for example – the photographic images we see are at least second and more likely third, fourth or even fifth generational re-presentations or performances of the originating script composition of optical information. Self-evidently this is so with negative/positive processes, but it’s equally the case with pictures from digital cameras. Their image data files – binary codes, invisible and inaccessible to the eye - require machine-coded translation into projection or printing instruction. Irrespective of any editing enhancement, the electronic journey from sensor to computer software to image processor to output printer driver necessitates multiple interpretation and reinterpretation, for example, of size, colour gamut, saturation, luminosity and edge transition as each link in the chain hands on the data down and up the line. Frequently, storage and recovery compresses and then loses electronic subtlety as the file becomes a *précis* of its former self.

These conversions, though translated by machine, are as determined by social and cultural expectation as by operational exigency. The aspirations for these aesthetics lie with the superlatives of photographic mythology – from cinema’s glorious Technicolor to

Kodachrome, from 'Moonrise Hernandez' to Mapplethorpe's nudes. Paul Coldwell, for example, has noted the 'uniformity of the surface' of digital prints in comparison to traditional forms of printmaking is due to the fact that the technology of such printers is 'aimed at matching the surface quality of analogue photography' (Coldwell, 2001). Paul Butzi summarises this as the *Silver Standard* – those idealised qualities and standards attributed to 'traditional' printing that inform the technical protocols and algorithms written to manage and enhance the realisation of digital imagery (Butzi, 2011). The air-dried, glossy, fibre-based silver gelatine print, for example, *circa* Ansel Adams, remains a platonic form of potent aspiration for monochrome digital work, the saturation of paintings and cinematic spectacle serve similarly for colour work and screen display. Going further, Kevin Hass believes that the digitalisation of all aspects of production now has weakened the ontological authority of the photographic image as a trace or manifestation of observed reality,

'We now operate in what is increasingly referred to as a 'post-medium era', where conceptual and pragmatic concerns overrule any strict conventions held by a particular medium. Practices, materials, ideologies all exist in a free mix of possibilities guided and inspired by the culture as a whole. Digital Media has often been at the center of this intermix, at times seeming to suck all other media into its realm. This convergence has been felt very strongly within the realm of photography, where the impact has been so extreme that some have heralded the 'death' of photography in a world where all images are suspect' (Hass, 2006: 4).

The syntactical articulation of one process in at least partial simulation of the values of a predecessor or competitor medium is perhaps the rule rather than the exception, driving the historical development not only of photographic and photomechanical printing but of earlier processes also. Contemporary photographic aesthetics are clearly subject to the capacities of the techniques and technologies of industrial production, but the design and capabilities of both commercial and domestic equipment and materials is equally informed by historically contingent cultural tastes, in Bourdieu's sense of the term, for pictorial appreciation and interpretation. A current example might be the efforts by manufacturers to develop ever

brighter, more saturated and more finely resolved display screens for mobile phones, tablets and computers. Concerns about the status of photographic imagery, were they to be entertained by the viewer, may be ameliorated or exploited by borrowing the authority of the appearance of earlier, perhaps more *authentic*, technologies – by wearing the cloak of another’s syntax. Somewhat paradoxically, black and white prints may now be deemed somehow ‘more authentic’, more objective or even more realistic than colour screen display.

A5.2 The research project's printing processes

A5.2.1 Salt printing

The Salt prints for the investigations reported in Chapters Five and Six were produced by 'salting' the paper substrates in a bath of 2% aqueous solution of Ammonium Chloride and, when dry, rod-coating with a 12% aqueous solution of Silver Nitrate at 1ml per 250 square centimetres. After drying, the sensitised coated papers were exposed under film or inkjet negatives to selected ultraviolet light sources, before being washed under running water, then 'fixed' in two baths of 3% solution of Sodium Thiosulphate and washed again in running water and allow to air dry.

A5.2.2 Albumen printing

The Albumen papers were prepared and processed in a manner identical to that of the Salt prints except that the papers were 'salted' with Ammonium Chloride (2% w/v) in denatured and filtered egg-white.

A5.2.3 Platinum/palladium printing

The platinum/palladium papers were rod-coated at 1ml per 250 square centimetres with an aqueous mixture composed of equal quantities of 25% Ferric Oxalate solution and a combination of 15% Sodium Chloropalladite and 20% Potassium Chloroplatinite solutions in a 60/40 ratio. After drying and exposure, the papers were developed in a 20% solution of Potassium oxalate, then cleared in three successive baths of 1% Hydrochloric Acid, washed for 45 minutes and air dried.

A5.2.4 Cyanotype printing

The Cyanotype papers were rod-coated at 1ml per 250 square centimetres with a mixture of equal quantities of 27% solution of Ammonium Ferric Citrate and 9% Potassium Ferricyanide.

After drying and exposure the papers were washed in running water for 20 minutes and air dried.

A5.2.5 Carbon-transfer printing

Commercially sourced carbon-transfer tissues¹ of pigmented gelatine were sensitised in 2.5% potassium dichromate aqueous solution for three minutes and, when dry, exposed under a film or inkjet negative to ultraviolet light. The tissues were then ‘mated’ underwater with their ‘receiving’ papers and pressed under weight for 30 minutes before ‘development’ in warm water and the removal of the tissue backing-paper and surplus pigmented-gelatine. After final washing the prints were air-dried.

A5.2.6 Photogravure printing

Commercially sourced photo-polymer plates² were exposed to ultraviolet light under a stochastic (aquatint) film screen of very fine dots. The plates were then re-exposed under a film or inkjet positive transparency and wash developed in standing water before being hot air dried and re-exposed to UV light. Test prints from the plates were made using Charbonnel F66 etching ink and pressed on paper stock that had been soaked for 20 minutes. The papers, after printing, were dried under pressure.

A5.2.6 inkjet printing

An Epson 3800 with K3 Ultrachrome ink set, photo-black, was used to print the negative transparencies and the reference prints on Epson ‘Photo-Glossy’ and ‘Matte’ inkjet paper

¹ Bostick & Sullivan: www.bostick-sullivan.com (accessed 21st January 2016)

² Toyobo Printight KM73 plates

A5.3

Phase A – Further results

The following tables show the reflectance density and gloss measurements of the six process and ten papers selected.

Salt process Paper	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.22	0.07	0.0	1.1	2.6
Aquarelle	1.19	0.09	0.0	0.6	1.7
Artistico	1.24	0.11	0.1	0.5	0.0
Cot 320	1.17	0.17	0.0	0.4	0.5
Fabriano 5	1.21	0.08	0.0	0.7	1.1
Hahnemuhle	1.18	0.08	0.0	0.5	0.5
Heritage Rag	1.07	0.06	0.0	0.1	0.5
Platine	1.22	0.09	0.0	0.1	0.8
Somerset	1.23	0.09	0.0	0.3	0.4
Zerkall	1.17	0.08	0.1	0.5	2.9

Table A5.3.1 Salt Process – Reflectance Density and Gloss measurements

Paper Albumen process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.46	0.04	0.9	16.9	16.3
Aquarelle	1.23	1.12	1.0	6.9	2.3
Artistico	1.27	1.04	1.1	10.5	9.5

Paper Albumen process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Cot 320	1.28	0.06	0.6	3.4	0.0
Fabriano 5	1.34	0.08	0.5	6.2	4.5
Hahnemuhle	1.18	0.09	0.2	3.1	2.0
Heritage Rag	1.32	0.06	0.9	6.3	8.2
Platine	1.24	0.04	0.5	6.7	1.7
Somerset	1.21	0.07	0.2	2.1	1.9
Zerkall	1.35	0.11	0.9	11.3	14.2

Table A5.3.2 Albumen Process – Reflectance Density and Gloss measurements

Paper Platinum process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.35	0.04	0.0	0.3	0.3
Aquarelle	1.45	0.1	0.1	0.6	0.7
Artistico	1.32	0.06	0.1	0.3	0.8
Cot 320	1.35	0.04	0.0	0.3	0.0
Fabriano 5	1.42	0.04	0.0	0.4	0.5
Hahnemuhle	1.29	0.06	0.0	0.0	0.0
Heritage Rag	1.43	0.05	0.0	0.4	0.3
Platine	1.36	0.04	0.2	0.6	0.5
Somerset	1.30	0.06	0.0	0.0	0.1
Zerkall	1.31	0.06	0.0	0.3	0.1

Table A5.3.3 Platinum Process – Reflectance Density and Gloss measurements

Paper Carbon- transfer process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.28	0.07	0.1	1.7	0.6
Aquarelle	1.25	0.09	0.2	2.7	3.3
Artistico	1.30	0.09	0.1	2.9	3.2
Cot 320	1.31	0.10	0.3	4.3	5.7
Fabriano 5	1.40	0.09	0.3	6.9	10.5
Hahnemuhle	1.29	0.09	0.1	2.4	2.1
Heritage Rag	1.32	0.08	0.2	3.4	0.0
Platine	1.45	0.08	0.2	2.4	2.5
Somerset	1.28	1.1	0.1	2.3	2.5
Zerkall	1.46	0.08	0.2	3.7	5.1
<i>Fixed-out silver gelatine</i>	<i>1.44</i>	<i>0.09</i>	<i>1.1</i>	<i>19.1</i>	<i>23.6</i>

Table A5.3.4 Carbon-transfer – Reflectance Density and Gloss measurements

Paper Gravure process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.41	0.06	0.0	0.0	0.0
Aquarelle	1.30	0.07	0.0	0.0	0.0
Artistico	1.33	0.06	0.0	0.1	0.1
Cot 320	1.45	0.06	0.1	0.2	0.2
Fabriano 5	1.39	0.08	0.3	0.7	0.8
Hahnemuhle	1.46	0.09	0.2	0.5	0.3

Paper Gravure process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Heritage Rag	1.42	0.08	0.3	0.9	0.9
Platine	1.38	0.08	0.2	0.4	0.4
Somerset	1.47	0.10	0.0	0.3	0.0
Zerkall	1.29	0.11	0.5	1.2	1.0

Table A5.3.5 Gravure Process – Reflectance Density and Gloss measurements

Paper Cyanotype process	Reflectance Density Dmax log-scale	Reflectance Density Dmin log scale	Gloss % at 20° incidence	Gloss % at 60° incidence	Gloss % at 80° incidence
Accademia	1.42	0.06	0.3	0.3	0.5
Aquarelle	1.46	0.09	0.5	0.6	1.6
Artistico	1.51	0.06	0.5	0.3	0.6
Cot 320	1.40	0.06	0.4	1.1	1.7
Fabriano 5	1.39	0.07	0.0	0.6	0.5
Hahnemuhle	1.28	0.08	0.4	0.8	0.0
Heritage Rag	1.41	0.07	0.4	0.8	0.8
Platine	1.28	0.07	0.5	0.6	1.3
Somerset	1.49	0.08	0.0	0.0	0.0
Zerkall	1.38	0.11	0.4	0.8	2.0

Table A5.3.6 Cyanotype Process – Reflectance Density and Gloss measurements

The following scans, show, as an example, the resolution target results for the ten papers for the Cyanotype process:

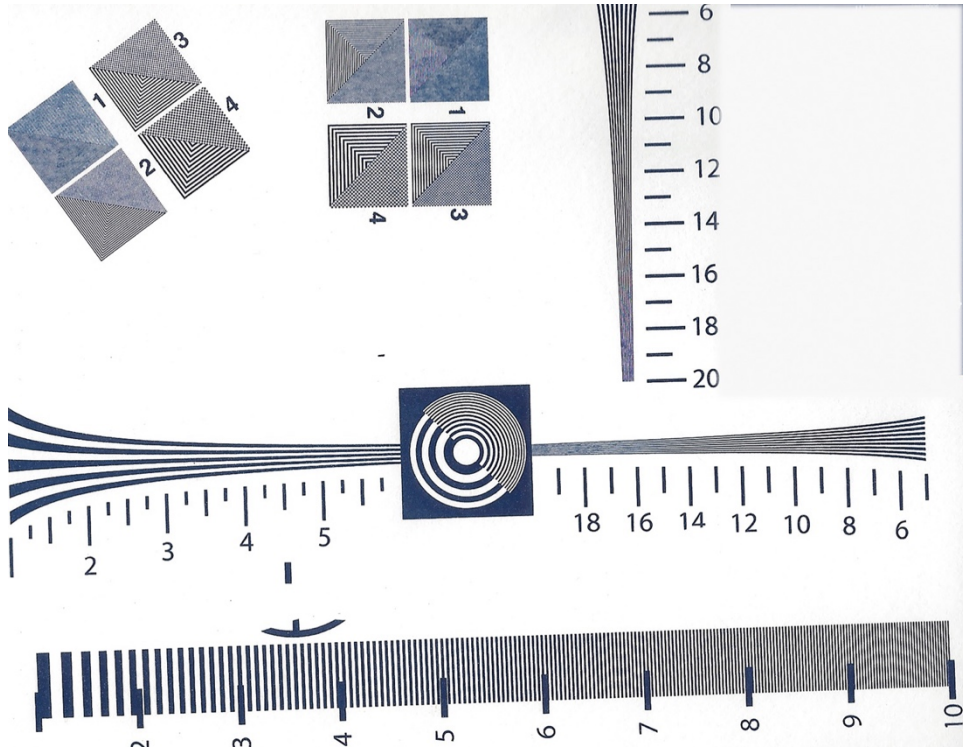


Illustration A5.3.7

Cyan resolution target Artístico

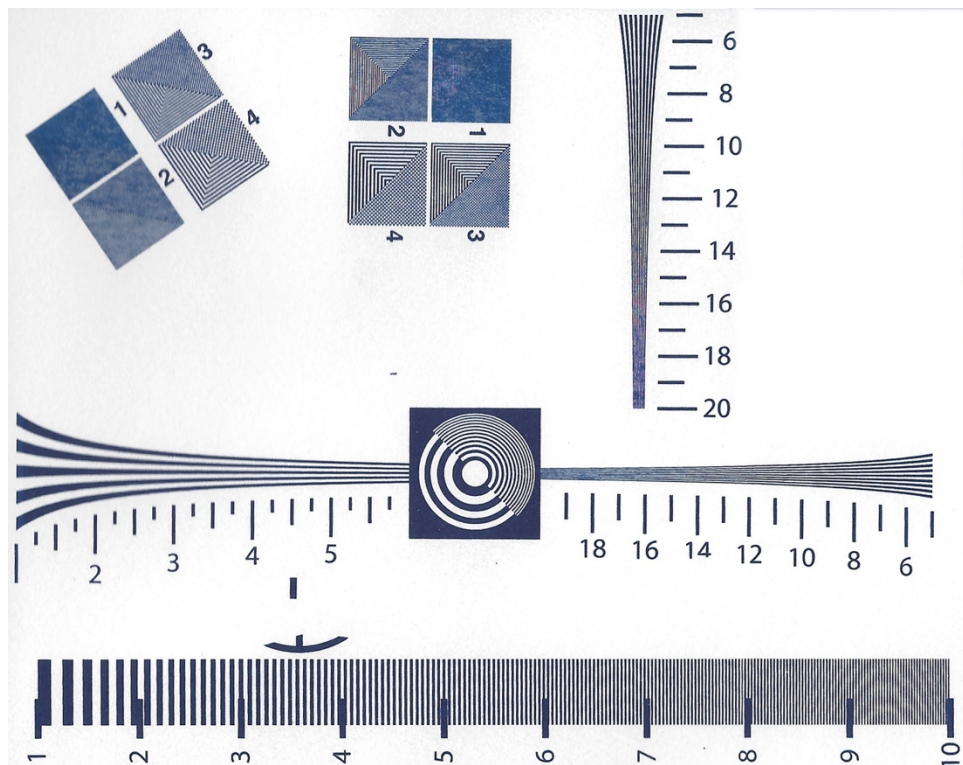


Illustration A5.3.8

Cyan resolution target Aquarelle

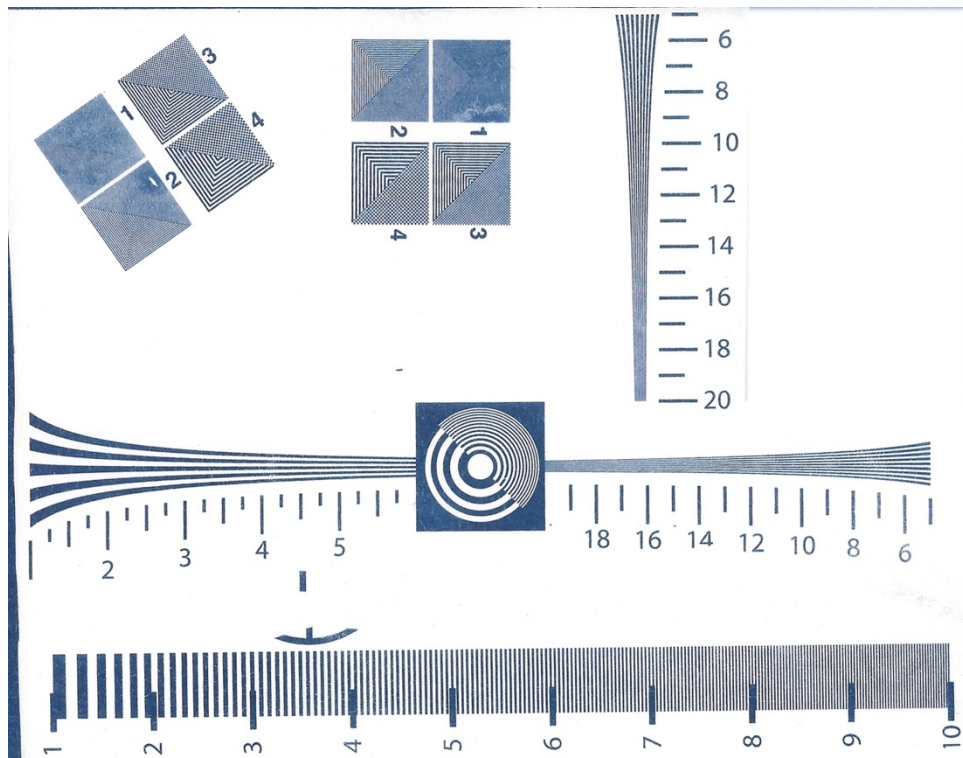


Illustration A5.3.9

Cyan resolution target Cot 320

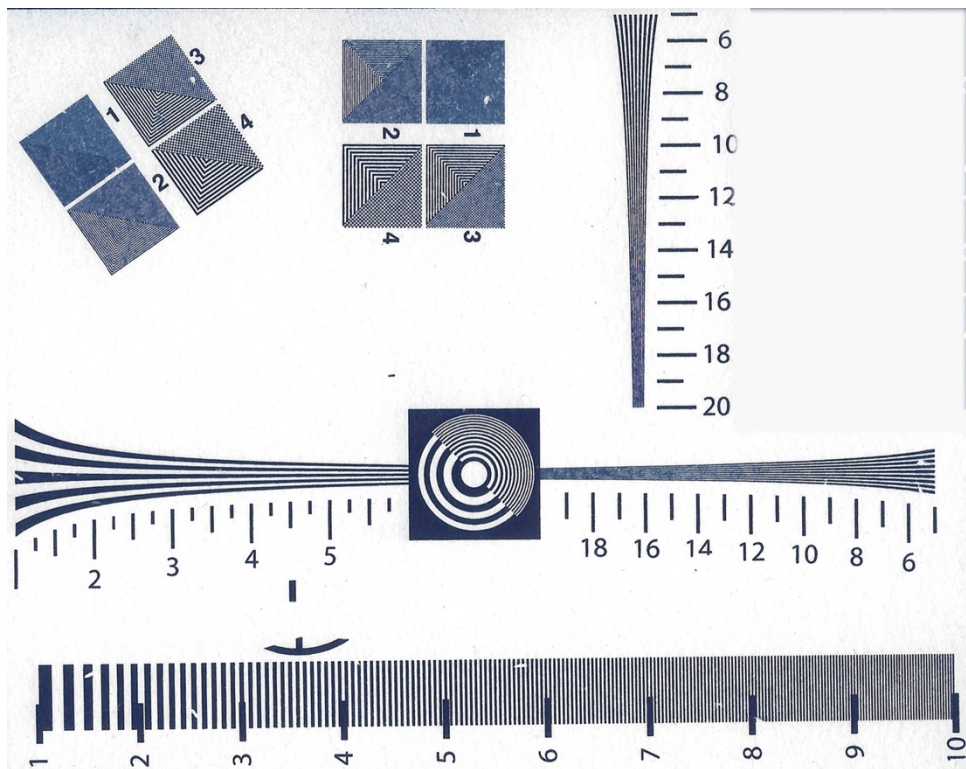


Illustration A5.3.10

Cyan resolution target Somerset

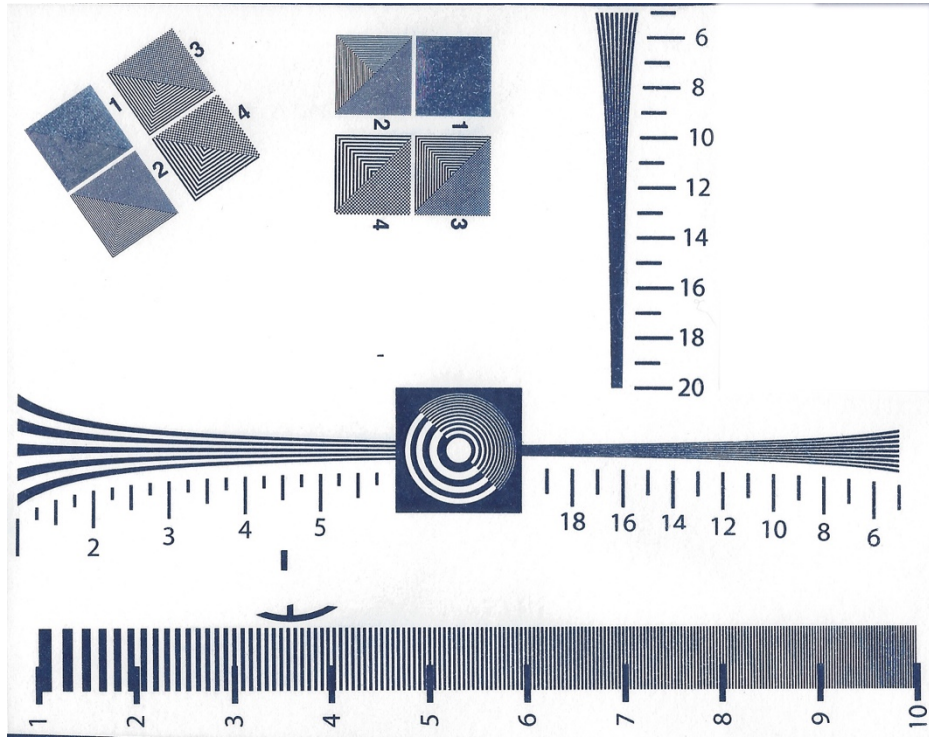


Illustration A5.3.11

Cyan resolution target Platine

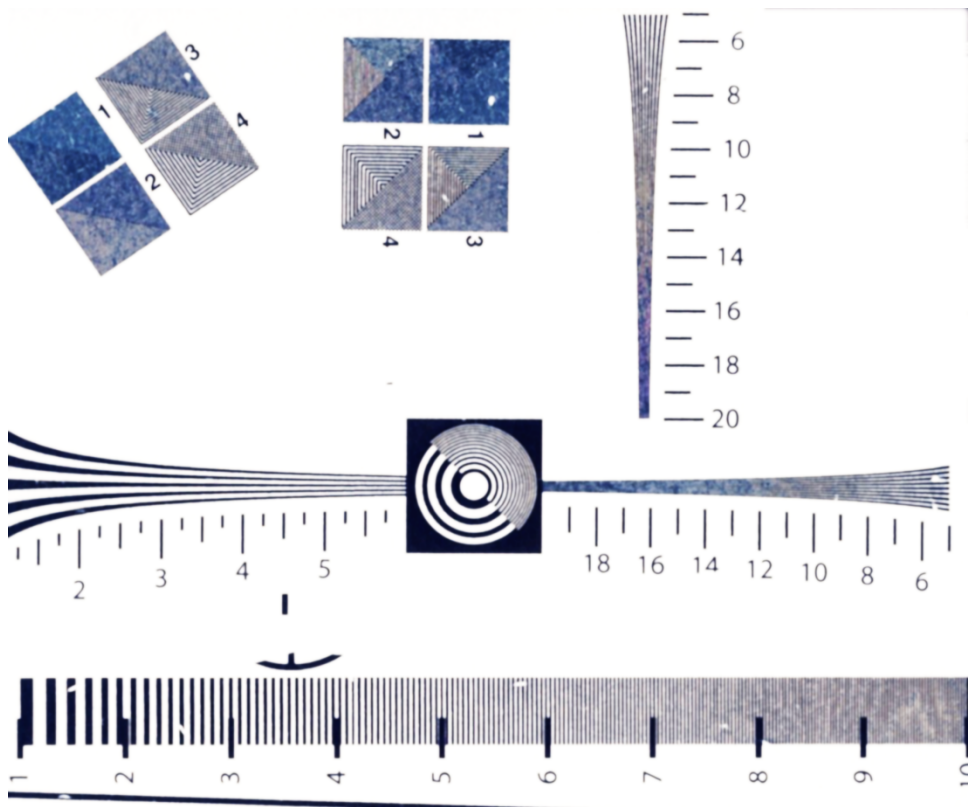


Illustration A5.3.12

Cyan resolution target Hahnemuhle

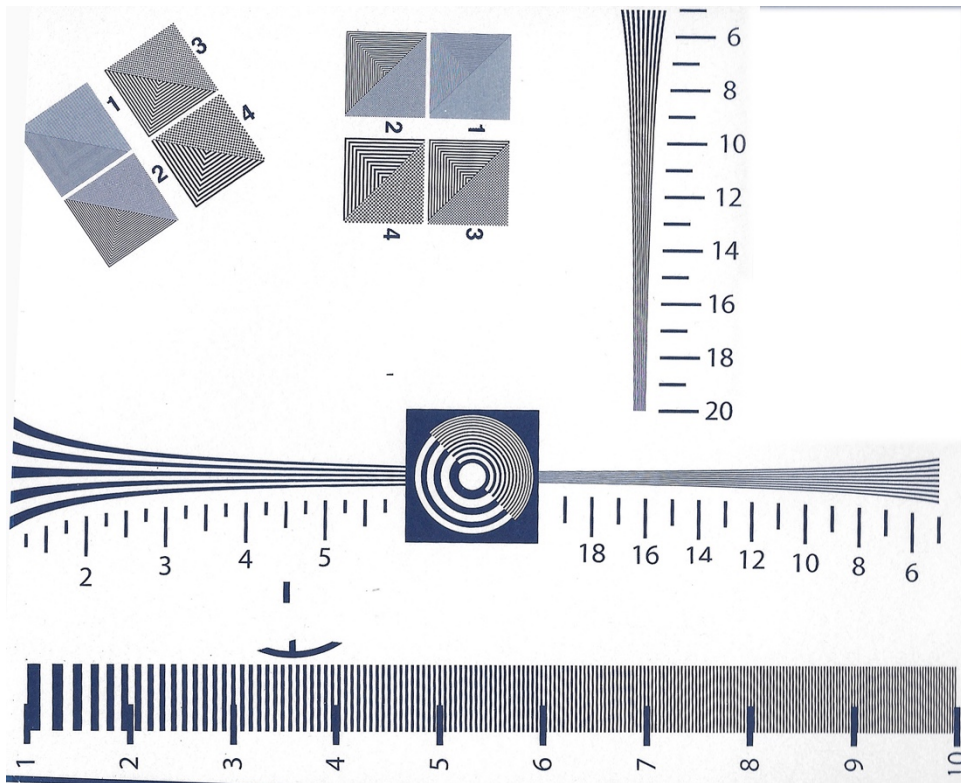


Illustration A5.3.13

Cyan resolution target Zerkall

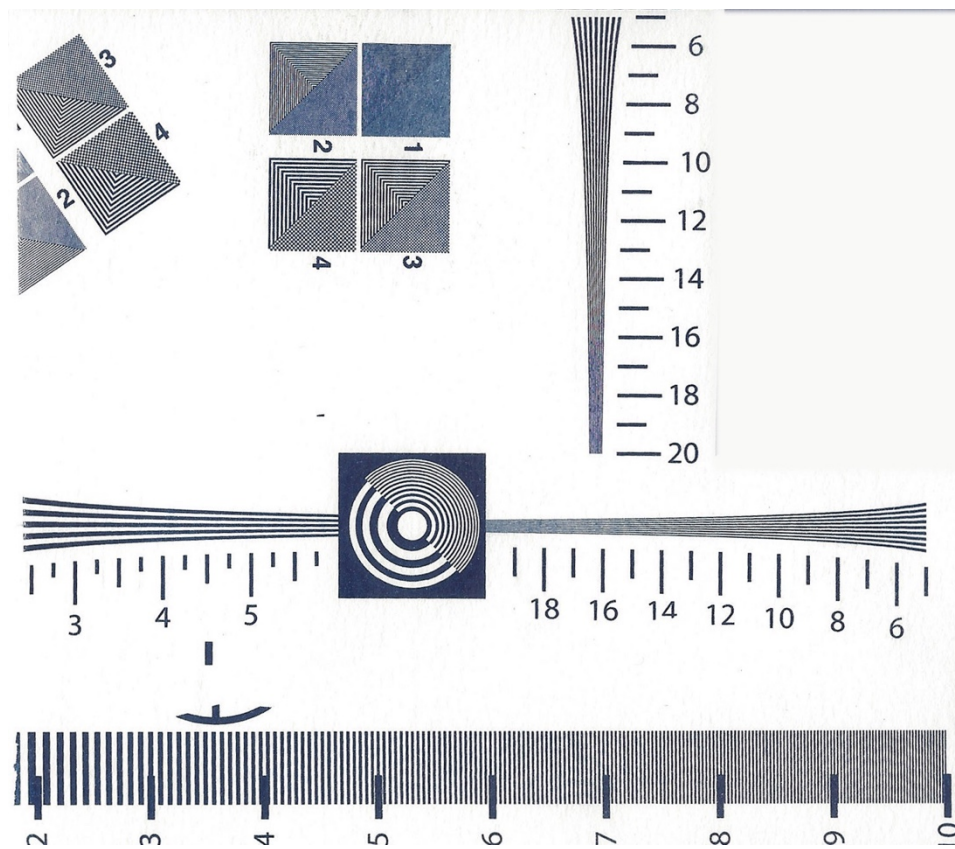


Illustration A5.3.14

Cyan resolution target Heritage Rag

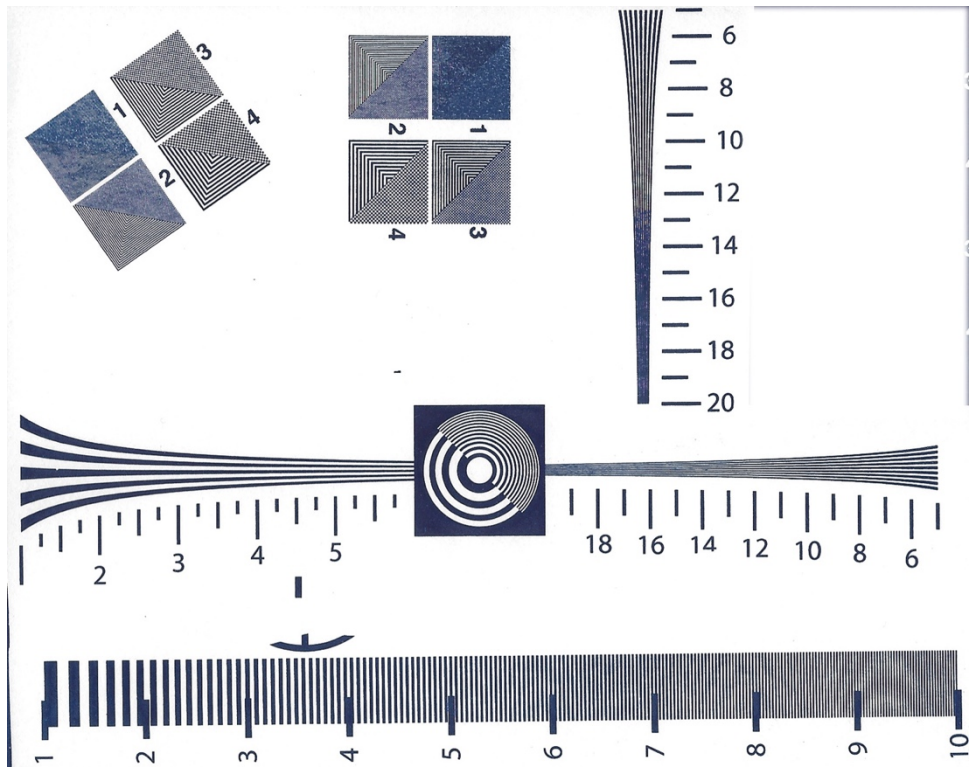


Illustration A5.3.15

Cyan resolution target Fabriano 5

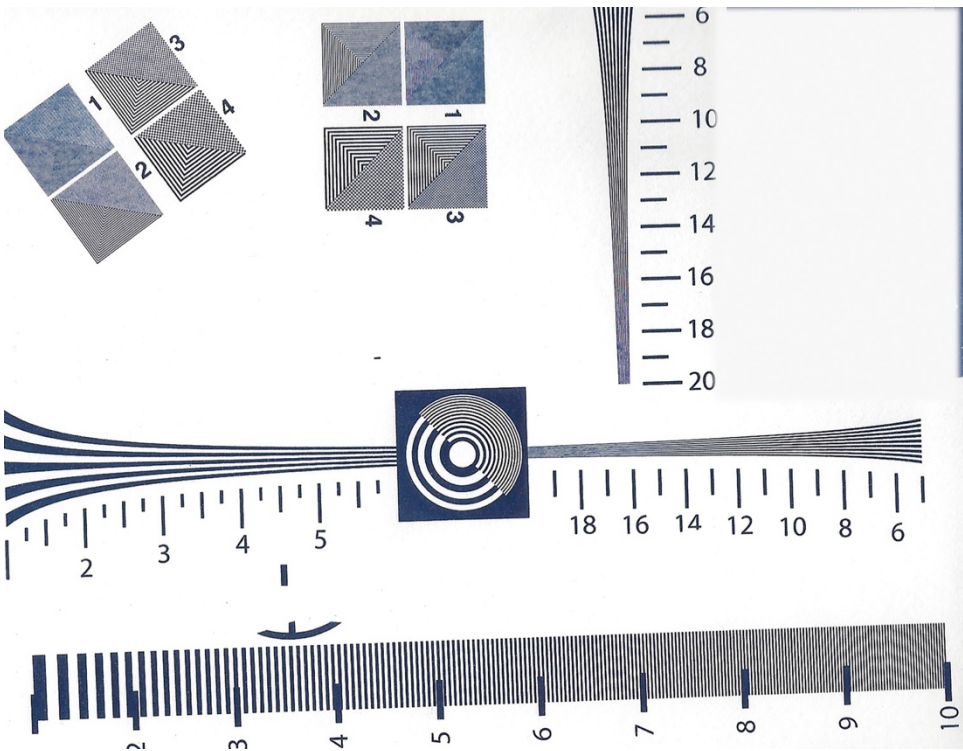


Illustration A5.3.16

Cyan resolution target Accademia

Appendix to Chapter Six

Appendix 6 provides background information (*section A6-Introduction*) and further detail in support of the commentary in Chapter Six regarding the use of digital inkjet negatives/transparencies for nineteenth century photographic contact printing processes. The investigations examined the relationships between the opacity of coloured inkjet negatives and three sources of ultraviolet light, the consequential effect on the reflectance densities secured in contact prints, and techniques for the *linearisation* and *calibration* of the negatives. They included the following topics, reported further below:

- UV transmission densities (opacities) of inkjet inks (*section A6.1*),
- Colour and density notation of image manipulation software (*section A6.1*),
- Ink lay-down patterns of inks on various substrates by printer type (*section A6.1*),
- Emissions spectra of a range of UV lamps (*section A6.2*),
- Absorption, by wavelength, of ultraviolet energy of photosensitive solutions (*section A6.2*),
- Relationships between UV sources, transparency ink colour and UV transmission density, photosensitive chemistry, and reflectance density of final print (*section A6.3*),
- Calibration and linearisation of inkjet negatives and minimisation of ‘posterisation’ and other digital artefacts (*section A6.4*),
- Summary and technical adaptations to maximise print resolution and tonal articulation and differential using inkjet negative transparencies (*section A6.5*).

A6 Introduction – digital inkjet printing

Commercial digital printing of ‘fine art’ and photographic prints dates from the late 1980s and early 90s, based initially on printers made by Iris Graphics. One of the first digital ateliers was Nash Editions, where the term *giclée* (or ‘squirt’) was promoted as one step in encouraging public acceptance of computer based fine-art printing. Inkjet history since then has been of continuous incremental improvements to the consumables – ink composition,

the numbers of colour cartridges utilised and inkjet papers – and to the reliability and capabilities of printer related hardware and software, including the market leader *Photoshop* image editing and processing program. Keeping pace with and facilitating these developments were digital camera innovations and the growing capacity and speed of computer platforms and operating systems. Within the space of twenty-odd years, digital origination, manipulation, and desktop and commercial output grew from conception to mid and now possibly later-life maturity.

The technologies and materials currently available provide for high quality inkjet printing in respect of product colour, tonal gradation, definition, detail, surface characteristics and longevity. Contemporary inkjet printers rival, and some may match, the results from wet chemistry photographic and photomechanical processes. Key aspects of equipment architecture are common across most printer manufacturers. With non-drum large format and desktop inkjet printers, the print head with multiple nozzles expels squirts of ink as it travels horizontally across the paper or substrate, which is moved forward over the head only a fraction of the head width at each pass. The image is built up by these parallel scans - known as *shingling* - that deposit overlapping dots of ink, building up colour by the subtractive process (subtracting wavelengths from the light reflected from the underlying substrate by adding ink).

Printer software makes use of two basic modes of digital construction of images. The '*object based*' or '*vector*' graphic uses geometric mathematical descriptions of curves, lines and forms, and in theory these are infinitely scalable. '*Bitmaps*', commonly if not universally used for more pictorial or photographic files, present images in terms of the properties of a map or matrix of their individual small elements or pixels – each pixel defined in the image file in terms of its mixture of primary colours (usually red, green and blue – RGB) or in respect of its colour hue, saturation and brightness (HSB). Screen images are produced by adding colour

output: white is shown through the full display of all three colours, black by the use of none of them, and all intermediate colour varieties by various proportions of the three. Digital definition of each pixel is translated into the four process primaries of cyan, magenta, yellow and black in order to be 'handed-on' to the printer software-driver for mapping against the available coloured ink cartridges in order for the printer-head to lay down the appropriate mixtures of ink.

The digital instructions for the mid-tones or halftones, of digital bitmap images are achieved by calculation, not by the rendering of a physical screening process. They cannot deliver genuine (photographic) continuous tone, but higher-end equipment provides a persuasive equivalent based upon expression of the tone and value of each pixel as fine patterns of ink deposition that stand very close scrutiny. Tone is created from 'spots' or 'subpixels' within a constituent matrix of *cells* that provide instructions for the printing of a single image pixel. A

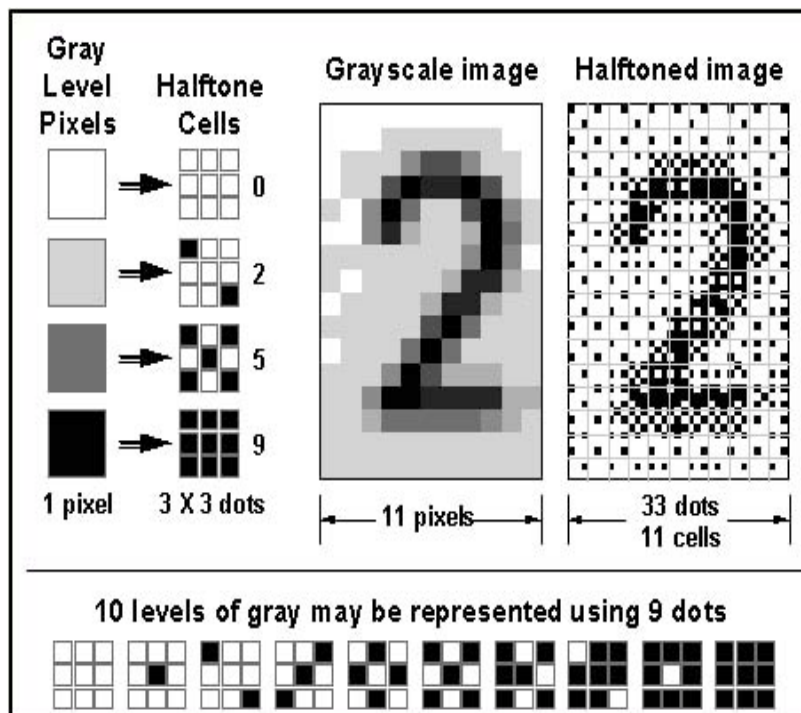


Figure A6-Introduction Representation of tones of individual pixels by dots (Torrey Pines, 2003)

3x3 'halftone' cell provides for each pixel to be printed as one of 10 levels or tones of gray, *Figure A6-Introduction* above (Torrey Pines, 2003), whilst a 12x12 spot cell or array, for example, theoretically provides for the representation of 145 shades. The methods used by inkjet printer software to calculate and order the distribution and size of the spots within each halftone (single pixel) cell have significant implications for the perceived visible quality of the print, and this issue is considered further in a following section.

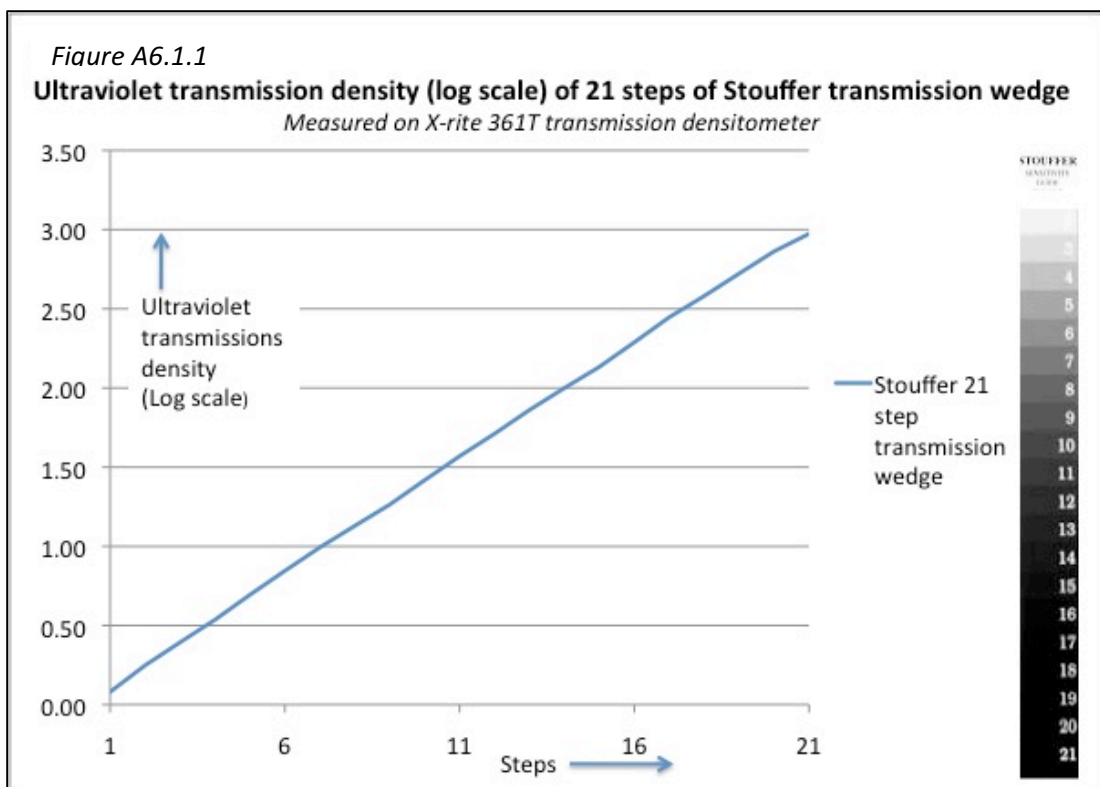
The precision of the physical operations of printers in terms of their control of exactly placed and timely squirts of ink from their heads whilst the heads themselves are moving, coupled with their management of paper advancement and movement, produces impressive results – enabled by the efficiency of the, unseen, digital procedures for halftone calculation and interpolation. The common reference to a printer's capability in terms of its ink '*dots per inch*' (dpi) is more accurately a specification of its *spatial addressability*, that is, the number of grid cells that can be addressed individually to trigger ink deposition within each linear inch. The Epson 3800 printer, used in this research, claims to offer 2880x1440 dpi, indicating that the grid of its addressability is only half as wide as it is high, which has implications for its rendering of the halftone cells described in the *Figure A6-Introduction*, above. There is a compromise in the choice of the grid dimensions of each halftone cell between its ability to articulate a range of densities (a 12x12 grid provides for 145 tonal representations and hence may contribute to a perceived smoothness of gradation) and its ability to resolve detail (a 3x3 grid with 10 tones is physically smaller and therefore can be printed at higher spatial frequencies). The resolution of this issue is finessed by manufacturers' ability to provide for modulation of delivered ink dot size within each placement in the halftone grid and, typically, by two further mechanisms – by the variable placement of dots across each cell grid and by the random or patterned distribution of halftone grids where, because of their small matrix, they either cannot represent the particular grey tone required or because the particular

image colours specified can be simulated only by dot combinations expressed from a number of cartridges.

The computer algorithms adopted to secure this halftone rendering – stochastic, dither patterning or error diffusion, for instance – form part of the signature or, indeed, the syntax of the digital output. In the case of the digital negative, discussed further below, this syntax shapes the definition and articulation of the contact print, adding its algorithms to those of the image’s capture and manipulation.

A6.1 UV transmission densities (opacities) of inkjet inks

In most circumstances and with most types of printer and substrate, it is rare for the tonal gradations and densities of digital inkjet negatives to match those of the originating file. Inkjet printers can usually reproduce on commercial inkjet paper a stepped wedge or ramp of evenly gradated tone, but struggle to replicate the tone changes correctly when printing on transparent films. *Figure A6.1.1*, below, plots the transmission density (opacity) to



ultraviolet light of each of 21 steps of a commercially produced grey-scale transmission ramp (Stouffer Industries). The graph shows a straight line indicating that the density increases uniformly at each step across the whole ramp. The ramp is manufactured to produce an increase in density of one camera f-stop (i.e. a doubling of density or 0.33 log scale) for each two steps, giving a total tonal range of 10½ f-stops.

Without 'linearisation' procedures, inkjet printers struggle to reproduce such uniformity of change. Conventionally, digital ramps or stepwedges are measured on computer screen by reference to '*greyscale density*' (0% to 100%) or, in the case of Adobe software, 256 Photoshop '*levels*' (0 to 255), the latter being more convenient when colourised negatives are used. These *levels* or *greyscale densities*, as indicated on the screen display, bear no consistent relationship to the transmission density of any subsequent inkjet printer output. The density and evenness of tonal change are factors of the inkjet printer hardware, its software driver and algorithms converting pixel specifications to ink deposition, its inks and the substrate. *Figure A6.1.2*, below, shows a selection of coloured digital stepwedges, constructed on screen to show a uniform increase in density/level across each of their 21 steps (in 5% increments). All contemporary 'high-end' inkjet printers hold multiple ink cartridges – usually variations on the process colours of cyan, magenta, yellow and black (CYMK). Translation of the on-screen colour specification – usually Hues, Saturation & Brightness (HSB) or Red, Green & Blue (RGB) – into printer instructions and ink deposition is accomplished by the collaboration of the software algorithms of the printer manufacturer (Epson in this case), the image editing software (Photoshop) and the computer operating system (Apple Mac). Whilst the on-screen densities show an even and equal increase across each of the 21 steps, the measured transmission density to both ultraviolet and visible light

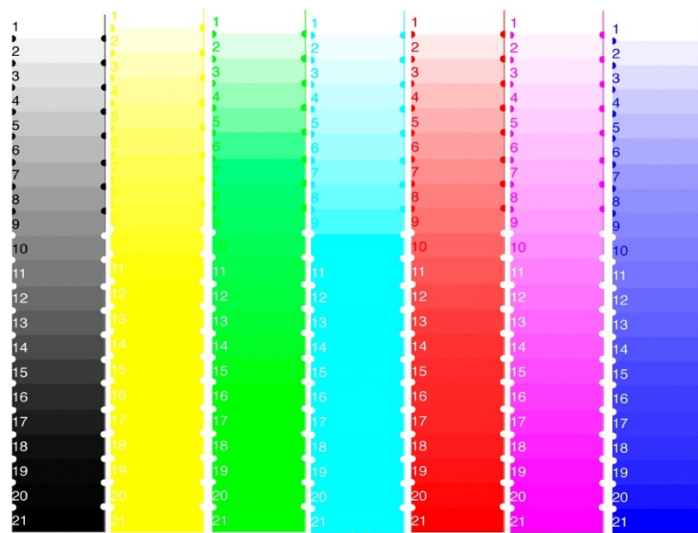


Illustration A6.1.2

Inkjet digital stepwedges

of the wedges printed on transparency substrate (Pictorico TPF100) is anything but uniform.

Figure A6.1.3, below, shows the inability of the Epson 3800 printer to reproduce the tonal gradation of the on-screen file.

None of the four coloured stepwedges prints an even gradation and, unless the printer output is 'linearised', inkjet negative transparencies will not produce contact prints with the tonal differentiation intended by the author. Before the process of 'linearisation' is examined, two digressions set out modes of colour specification and printer control that impact on negative production.

Digital colours exist in 'colour space' conventions that determine the gamut (range) of colours that can be articulated – for example, Adobe RGB, proPhoto or sRGB. Within each space, screen colours may be specified through a number of descriptive systems. The most commonly employed are Hue, Saturation and Brightness (HSB), the process colours of Cyan, Magenta, Yellow and Black (CMYK), and Red, Green and Blue (RGB). In the main, this research project uses the HSB notations. A representation of the scheme is shown in Illustration A6.1.4, below, and examples are shown in Table A6.1.5 and A6.1.6,

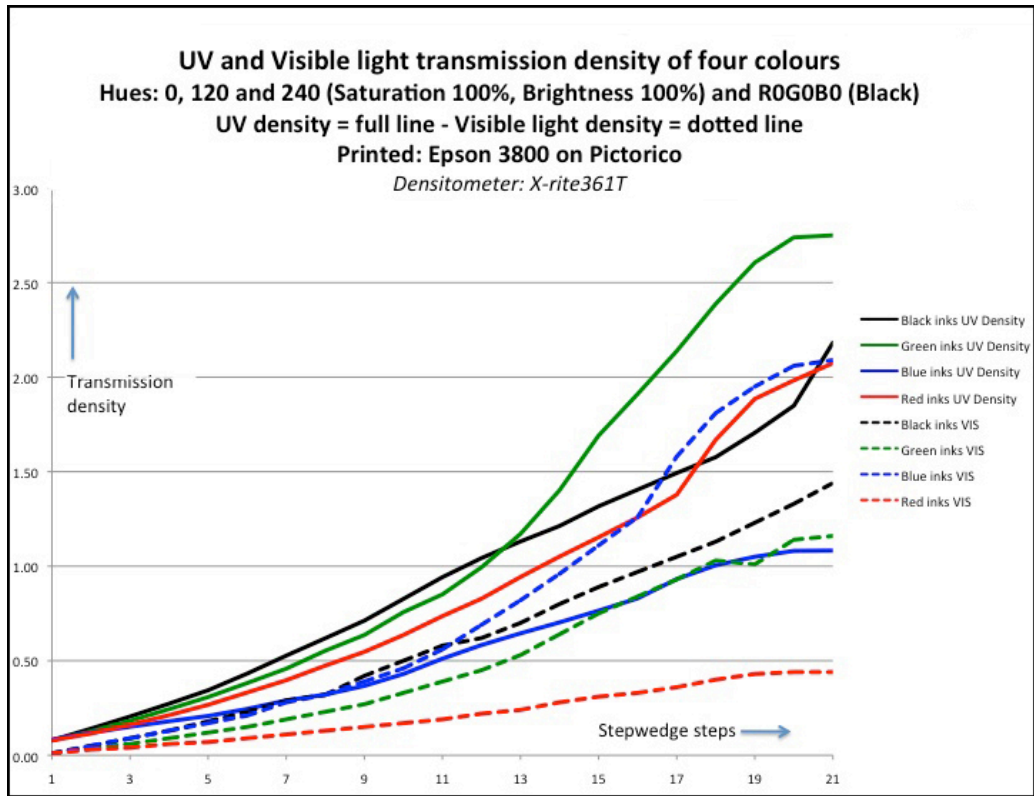


Figure A6.1.3 Transmission density of coloured stepwedges

below, with conversions to CMYK and RGB. CMYK references are percentages, RGB references are Photoshop's 256 'level' measures – Level 0 is nil colour contribution, level 255 is full contribution. Algorithm conversions, by the printer driver software, from HSB, CMYK or RGB specifications to machine instructions to put ink on paper from any of the eight cartridges (Epson 3800) are proprietary and not available for inspection.

An advantage of using HSB colour selections, providing the Brightness level is maintained at 100%, is that the printer does not start adding black ink to its output with consequential uncertainties about opacity to UV. Table A6.1.5, below, shows that when Brightness is at 50%, the CMYK conversion – and printer drivers work with CMYK – adds significant black ink. Proprietary software is available that overrides printer and Photoshop control and allows

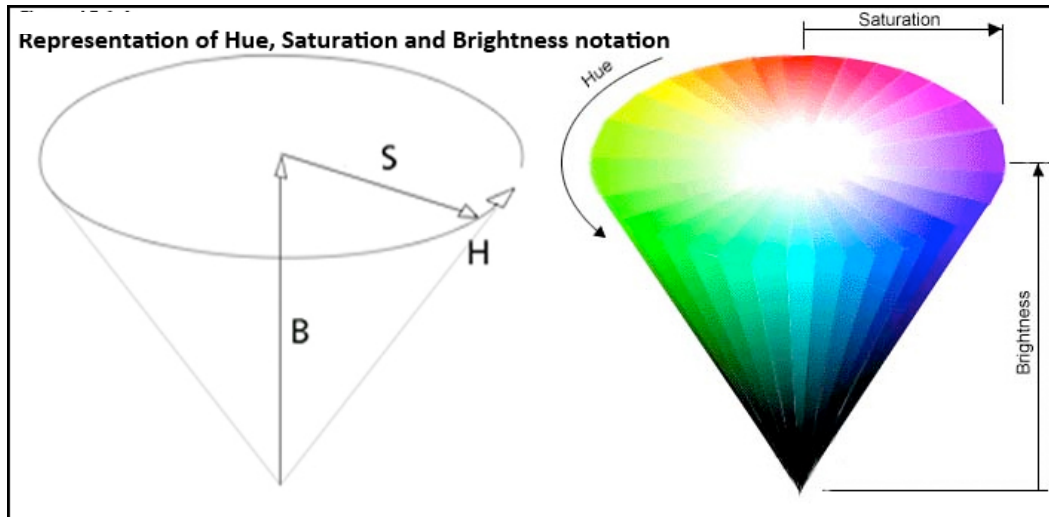


Illustration A6.1.4 Representation of Hue, Saturation and Brightness notation

Table A6.1.5

Hue	C	M	Y	K	R	G	B
0°	0	100	100	0	255	0	0
15°	0	75	100	0	255	64	0
30°	0	50	100	0	255	128	0
45°	0	25	100	0	255	191	0
60°	0	0	100	0	255	255	0
75°	25	0	100	0	191	255	0
90°	50	0	100	0	128	255	0
105°	75	0	100	0	64	255	0
120°	100	0	100	0	0	255	0
135°	100	0	75	0	0	255	64
150°	100	0	50	0	0	255	128
165°	100	0	25	0	0	255	191
180°	100	0	0	0	0	255	255
195°	100	25	0	0	0	191	255
210°	100	50	0	0	0	128	255
225°	100	75	0	0	0	64	255
240°	100	100	0	0	0	0	255
255°	75	100	0	0	64	0	255
270°	50	100	0	0	128	0	255
285°	25	100	0	0	191	0	255
300°	0	100	0	0	255	0	255
315°	0	100	25	0	255	0	191
330°	0	100	50	0	255	0	128
345°	0	100	75	0	255	0	64
360°	0	100	100	0	255	0	0

Hue – varied,
Saturation 100%, Brightness 100%

Hue – varied,
Saturation 100%, Brightness 50%

printing directly from nominated ink cartridges. 'Quadtone RIP' is effective in this regard and 21 stepwedge transparencies produced under its direction allow density measurement of the individual cartridge inks that is not possible with printer and Photoshop control.¹ The UV transmission density of the inks from individual cartridges printed on Pictorico transparency film by an Epson 3800 is shown below, *Figure A6.1.6*. The graph shows that,

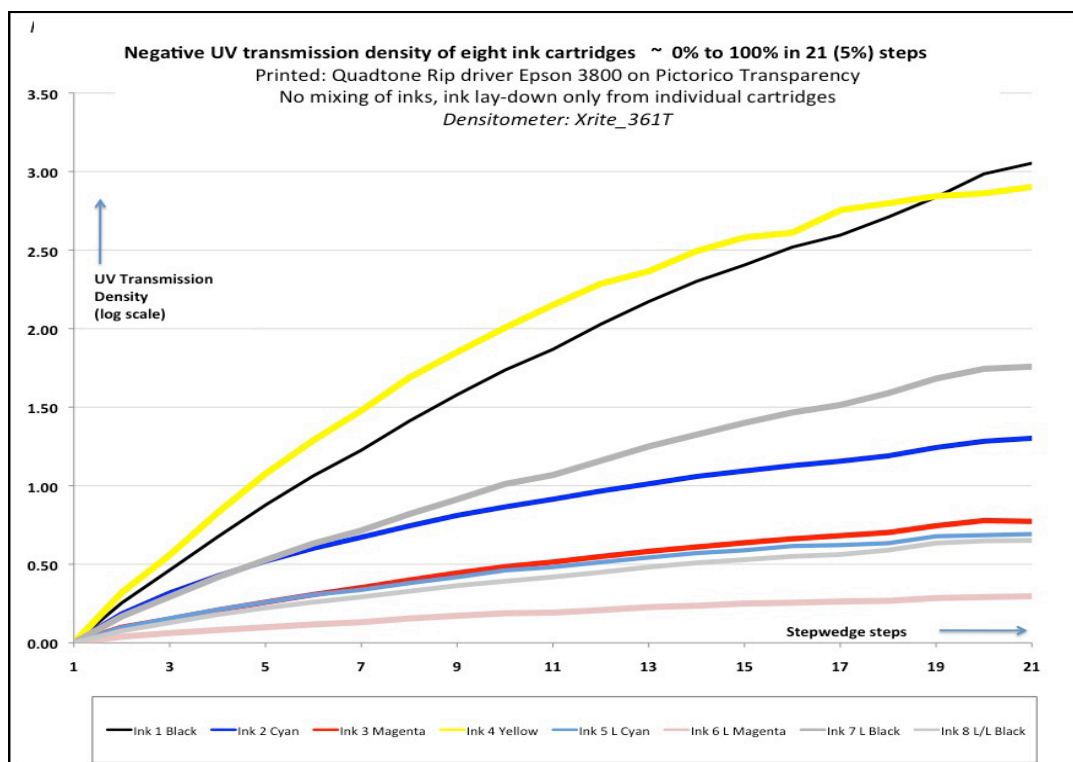


Figure A6.1.6 UV transmission density of eight ink cartridges printed by RIP

when unmediated by the Epson and Photoshop software drivers, the inks are laid down in a more even – but still not quite linear – gradation. The yellow and black inks exhibit a maximum opacity that equals that of the Stouffer transmission stepwedge, but the magenta, light black, light-light black, light magenta and light cyan cartridge inks have comparatively little UV blocking power. It is clear from these data that the strong opacities to UV shown by the green and blue inks (*Figure A6.1.3*, above), on stepwedges printed with inks from combinations of cartridges, stem from the properties of the yellow and cyan cartridge inks.

¹ <http://www.quadtonerip.com/> (accessed 5th December 2015)

Micrographs of the lay-down of these inks illustrate the operation of these combinations, but also make clear some of the limitations of inkjet printing on substrates. *Illustration A6.1.7*, below, shows enlargements at 20x and 400x magnification of a matrix with two-pixel wide

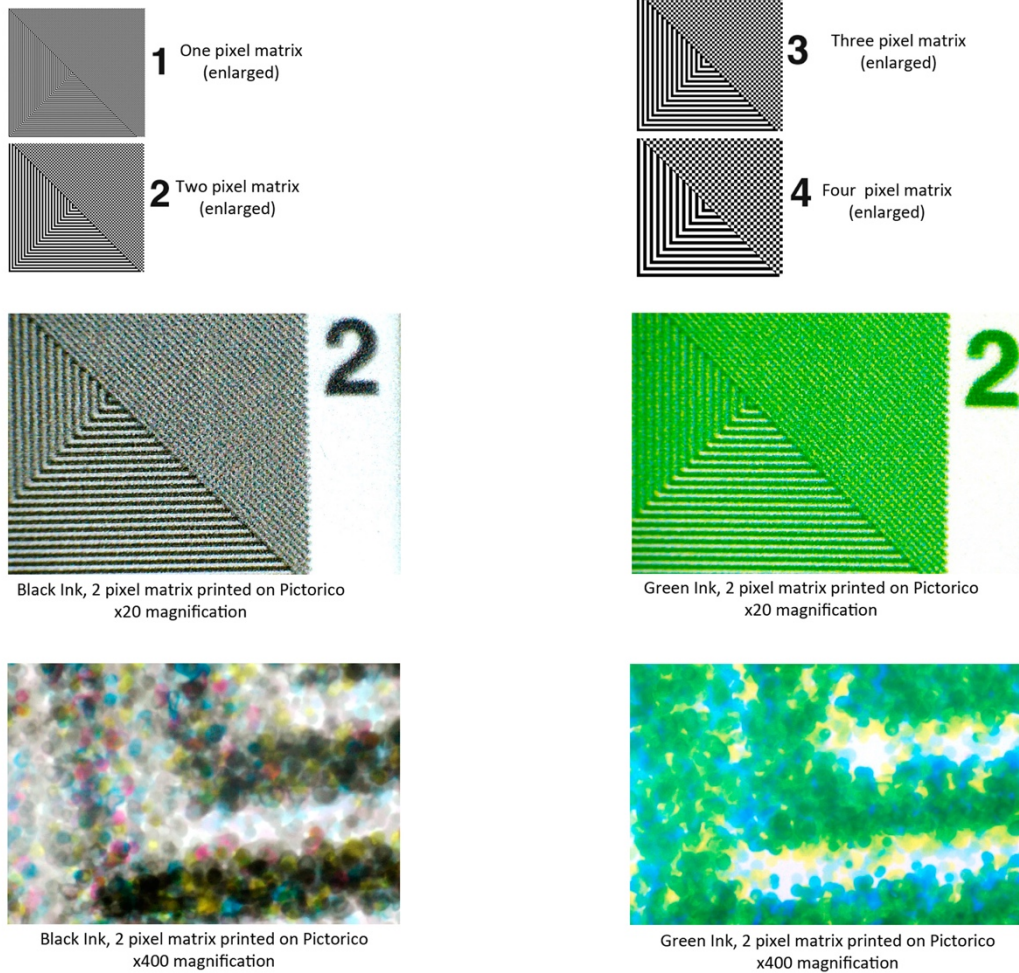


Illustration A6.1.7

Digital Pixel Matrices

lines/grids with green and black ink on Pictorico substrate using an Epson 3800 printer. Examples, enlarged for visibility, of the originating matrices at one, two, three and four pixel line widths, are included at the head of the illustration.² The 3800 printer, and all others tried, proved unable to print a 1-pixel matrix on transparency substrates, the one pixel wide

² The pixel matrices provided by 'Precision Digital Negatives', courtesy of Mark Nelson (Nelson, *n.d.*)

grid and lines blocked up. The 2-pixel matrix was resolved but, as both magnifications show, there is significant contamination of the spaces between the grid lines. The composition of the black ink, with colours drawn also from yellow, magenta and cyan cartridges, is clearly evident; as is the mixture of yellow, cyan and light cyan that forms the green colour. It appears that on the transparency substrate the ink squirts remain separate on the coating and do not bleed fully into one another, there is super-imposition rather than mixing. The contamination of the spaces is more marked on the vertical than on the horizontal lines, evidence perhaps of the 2880x1440 dpi resolution of the printer. These limitations of resolution are significant for contact-printing – if the negative doesn't carry the detail, then it is impossible for it to be recovered on the print. Additionally, the different coloured inks making up, in the case of *Illustration A6.1.7*, the appearance of green and black, have differential opacity to UV light and the print mottling in the fine spaces is potentially exacerbated by the varied UV density of the 'rogue' ink drops. However, this is failure of resolution at the limits of human visibility. At 300 pixels per inch (ppi), the contamination of the 2-pixel grid, where the spaces are only 1/150 inch wide, is unlikely to be visible on the print at normal viewing distances.

By comparison, the different UV opacities of the constituent inks of the green, black and blue colours are of greater significance for print tonality and resolution. As darker shades are required – whether they be green, black or blue coloured negatives – it's not simply that more ink is laid down, the colour-recipe changes and the printer driver varies the relative contribution from each cartridge, and it is the proportional contribution that determines the patch density of UV transmission and the densities of the 'overspill contamination' of ink squirts into what should be white or low density spaces.

A6.2 Ultraviolet wavelength emissions and absorption

The UV opacities of particular inks, the changing proportions of ink combinations as density increases and the 'lay-down' patterns and ink overspill are not the only variables that affect the character, calibration and use of ink-jet printed negatives. There are three key additional variables: the type of printer, the type of substrate and the nature of the UV source. If any of these are changed, then recalibration and linearisation of the inkjet negative is required.

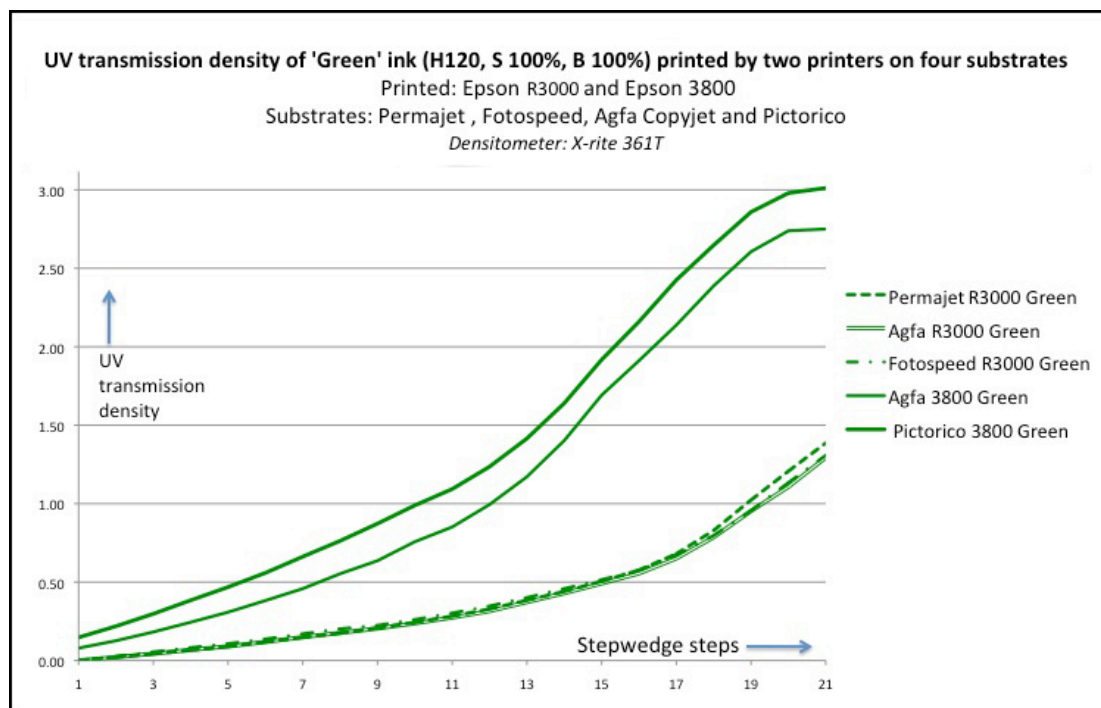


Figure A6.2.1 UV transmission density of Epson K3 Ultrachrome Green Ink

Figure A6.2.1, above, shows the transmission densities of a digital 21 stepwedge printed on both Pictorico and Agfa Copyjet transparency film through an Epson 3800 and an Epson R3000 printer, using ostensibly the same Photoshop settings. The difference in opacity secured by the different printers is evident and whilst the R3000 produces comparable opacities on three different substrates, there is significant variation on the 3800. These differences hold when the printer output is controlled separately by *Quadtone RIP*, printing

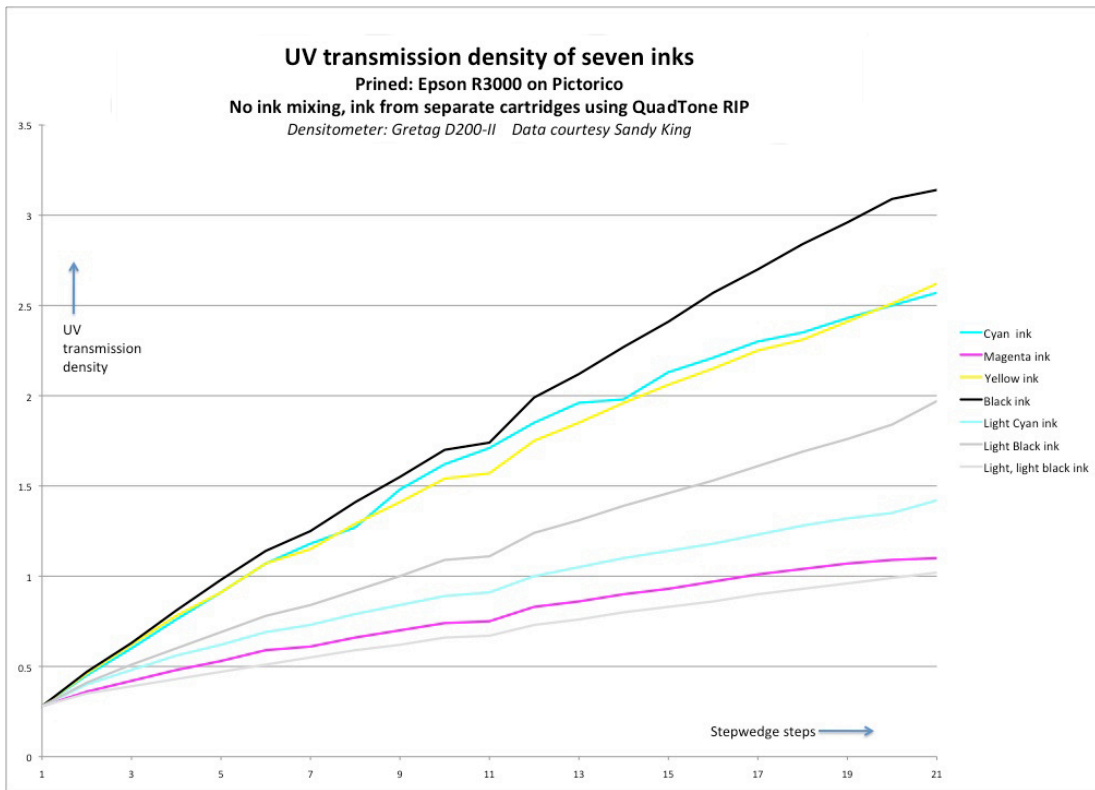


Figure A6.2.2 UV transmission density of seven Epson inks printed with RIP

from the individual cartridges. R3000 printer results from an American practitioner, Sandy King³ in comparison with the equivalent data from an Epson 3800 show marked differences in the UV opacity of the cyan and black inks on the same substrate type.

There are two important issues, not yet considered, concerning the measurement of UV transmission density with regard to the sensitivities of the densitometers used and the variable opacity of the inks to different wavelengths within the UV spectrum. Firstly, UV transmission densitometers are manufactured to respond to set wavelength bands. The model used for this research project, the X-rite 361T, has a responsiveness that peaks at 380nm and ± 20 nm falls of relatively quickly either side. This 40nm band is appropriate as it is the part of the UV spectrum to which most early contact-printing processes are sensitive. Erich Camerling, a Dutch practitioner, made measurements available for this project using a

³ Private correspondence, April 2014

densitometer sensitive to a narrow waveband around 365nm. Two graphs, below, show the UV transmission densities of inkjet stepwedges – linearised to produce even increase in density – as measured by the X-rite 361T (380nm peak) and Camerling’s 365nm equipment. *Figure A6.2.3*, below, shows the densities of red and black stepwedges printed through Photoshop (i.e. inks are mixed from the supplying cartridges) and, in *Figure A6.2.4*, below, those of yellow and cyan inks printed through Quadtone RIP (where inks are not mixed and

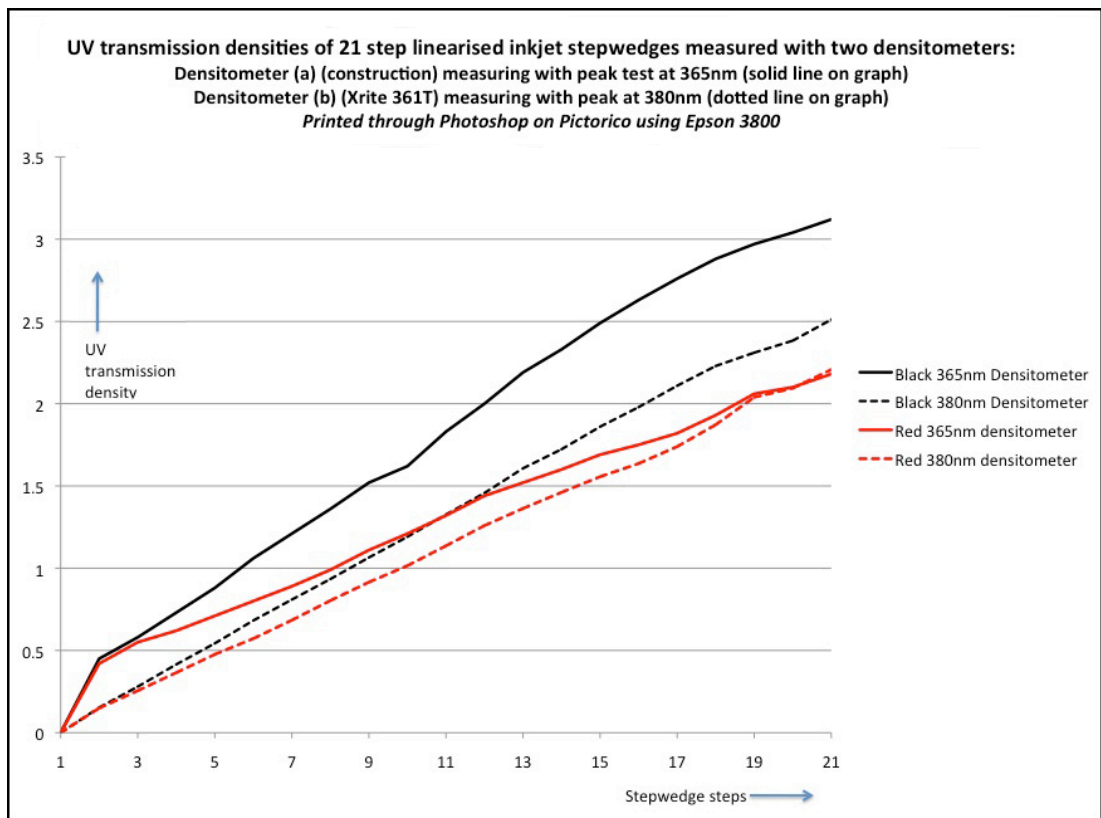


Figure A6.2.3

are printed only from separate cartridges). In both cases, the two densitometers report different density curves. The inference, therefore, is that the inks exhibit different opacities to different wavelengths of UV emission.

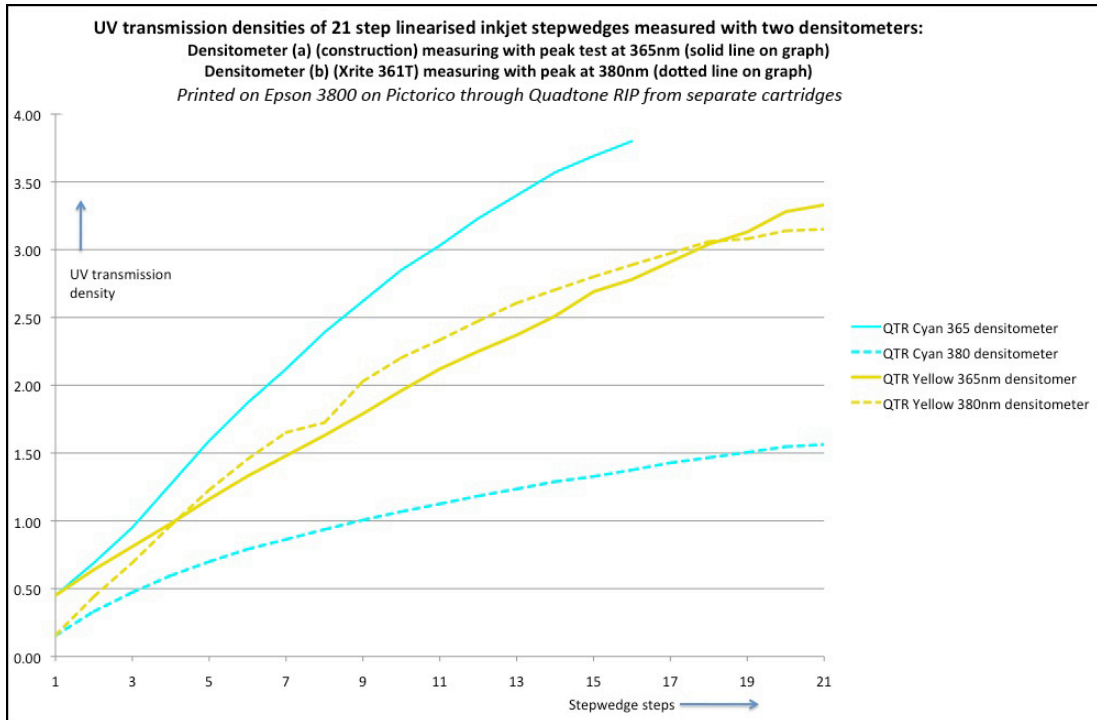


Figure A6.2.4 UV transmission densities of two inks measured with two densitometers

The second issue relates to the emission spectra of the UV sources and the responding sensitivities of the photosensitive coatings. Early photographic contact-printing printing processes are sensitive to UVA wavelengths (broadly 315-400 nanometres) and some retain photo-responsiveness into the visible low-wavelength violet/blue spectrum between 400 and 450nms. Their sensitivity below 350nm is mitigated by the UV absorption of the glass in the printing frames. Early practice relied upon the sun’s radiation, which is powerful across the whole UV spectrum. Artificial sources exhibit more restrict emissions. *Figure A6.2.5*, below, shows the emissions spectra of seven UV sources used in this research. The graphs give no indication of the energy output of the sources, which vary greatly across the different lamps, the emissions spectra are plotted separately for each source against its peak output. Both the incandescent and fluorescent bulbs provide broad waveband discharge, the LED bulbs – by design – have comparatively narrow spectra.

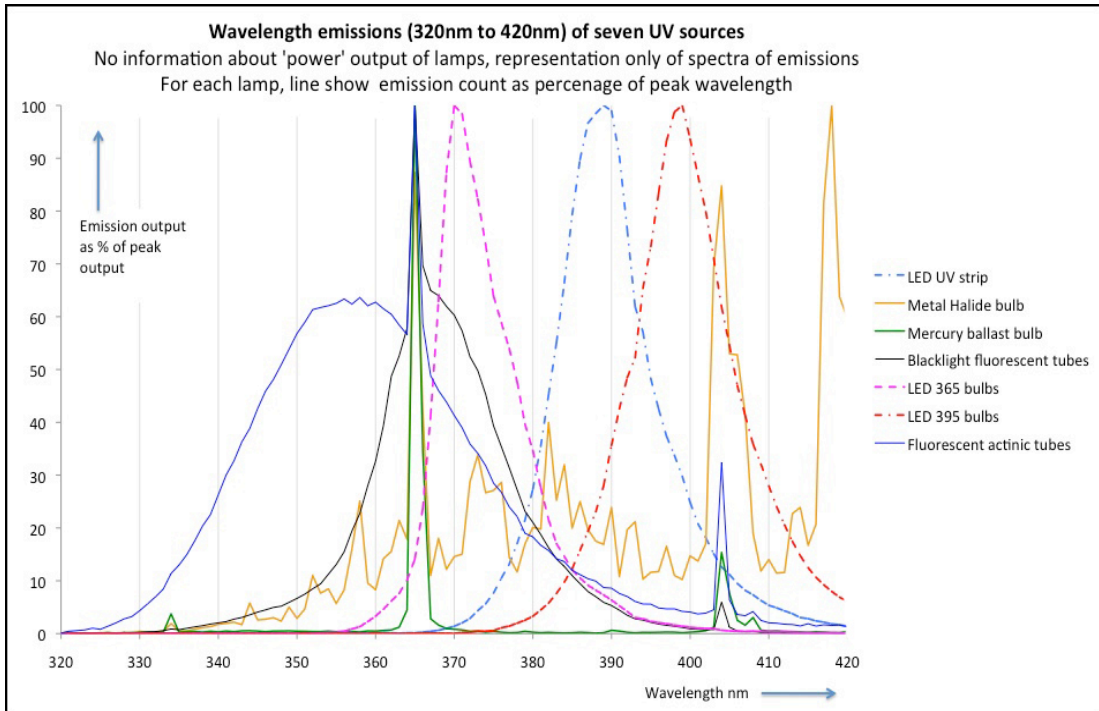


Figure A6.2.5 UV emissions recorded on 'Avantes AvaSpec' spectrometer

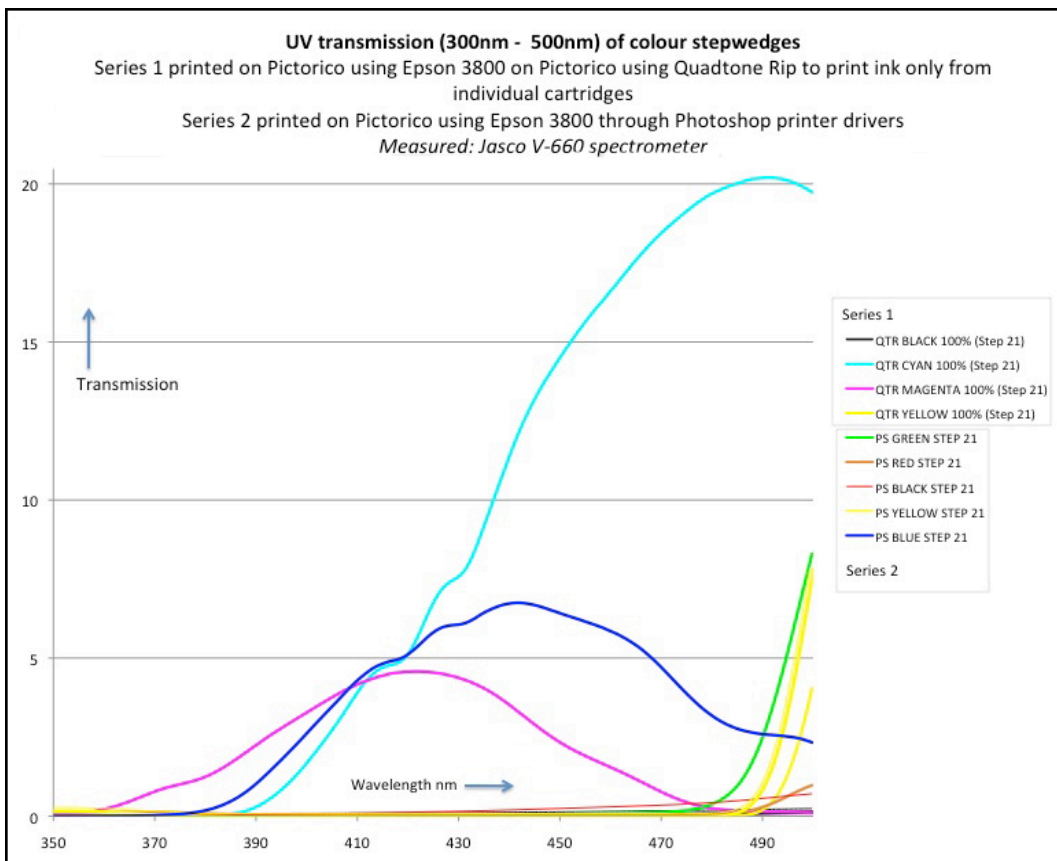


Figure A6.2.6

In order to examine the interplay between lamp spectra and negative transparency transmission density, Warwick University Chemistry Department (Warwick Scientific Services) assisted with the measurement of the transmission density of inkjet stepwedges across a broad UV spectrum using a Jasco V-660 spectrometer. *Figure A6.2.6*, above, plots the transmission density of Quadtone RIP (QTR) and Photoshop printed coloured stepwedges. An expanded section of these data is shown below in *Figure A6.2.7*. It is evident, with procedures managed by both QTR (printing from individual cartridges) and Photoshop (mixed inks from cartridges), that UV opacity of the inked substrates, differentially for each colour of ink, varies across the specific waveband spectrum to which the early photographic processes are sensitive. This is a complex set of relationships to disentangle. The opacity of

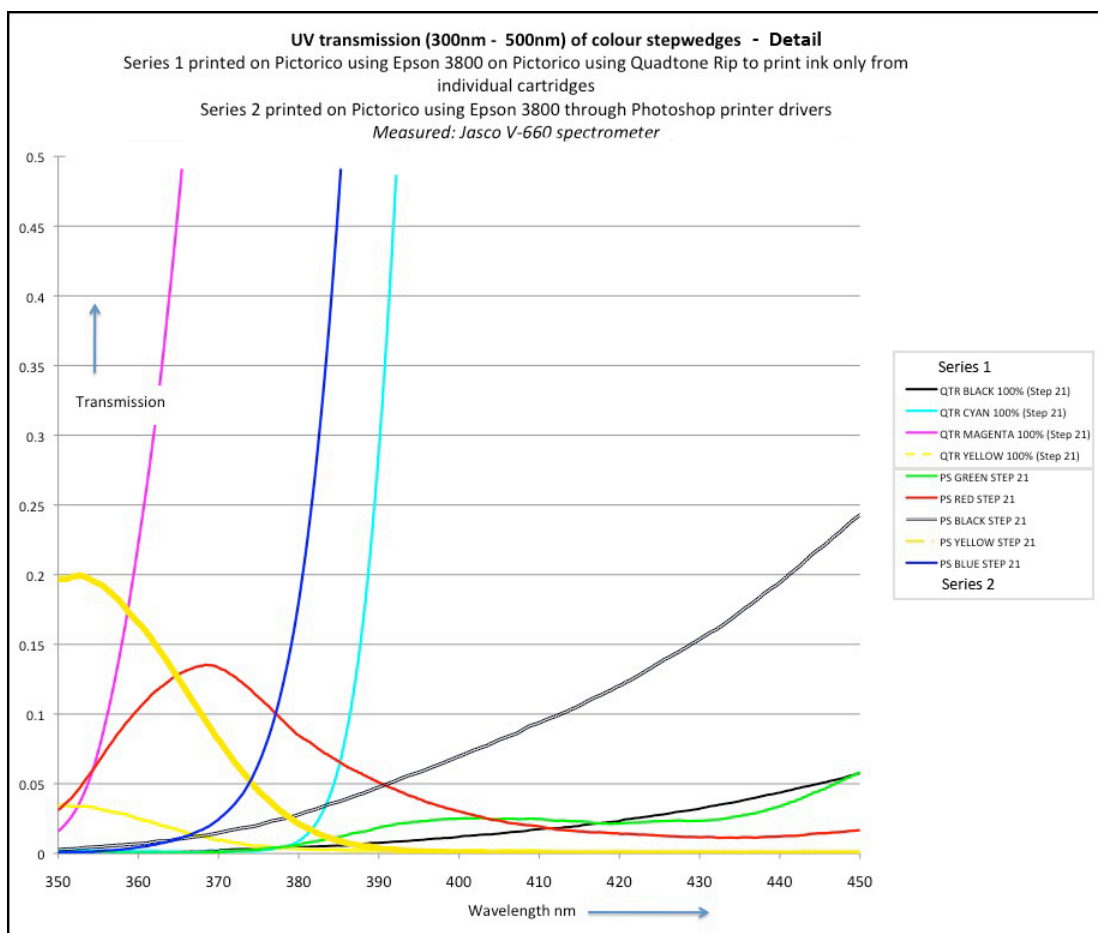


Figure A6.2.7 UV transmission density of coloured stepwedges, data courtesy of Warwick University

inkjet negatives is a function of printer and ink, software driver, substrate type and UV source, and their opacities vary differentially, depending on ink, printer etc., across the wavelength band to which the photochemistry is sensitive. Additionally, the chemistries themselves – though sensitive across a relatively broad UV waveband range – are more energetic at some frequencies than others. Warwick University assisted in determining the UV transmission rates (serving as a proxy for absorption and chemical reactivity) of three commonly used photo-sensitisers: ferric oxalate, ferric ammonium citrate and potassium dichromate. Their data is shown in *Figure A6.2.8*, below. Whilst potassium dichromate appears strongly absorbing across the full UVA spectrum, both the ferric salts exhibit declining absorption from 350nm upwards. How their declining absorption with the wavelength increase may correlate with final print density is unknown. Increases in exposure may compensate for the inferred reduction in reactivity, or it is possible that tonal differentiation or even print resolution may be affected. A further set of tests was carried out, to assess how different coloured inkjet stepwedges absorbed UV emissions across the waveband spectra of a variety

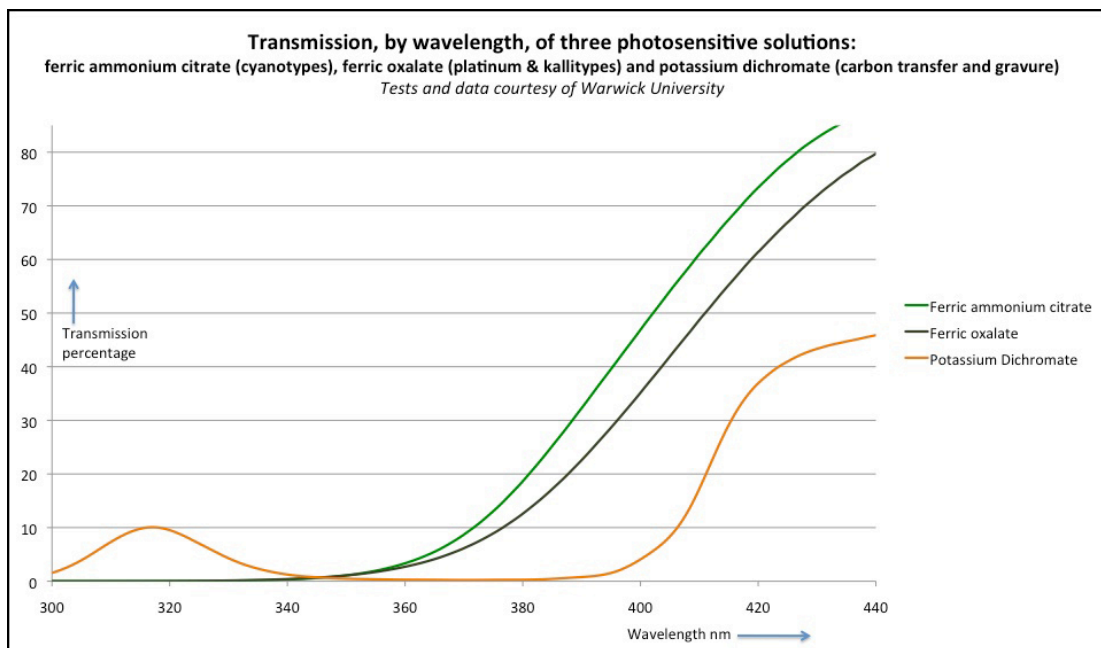


Figure A6.2.8

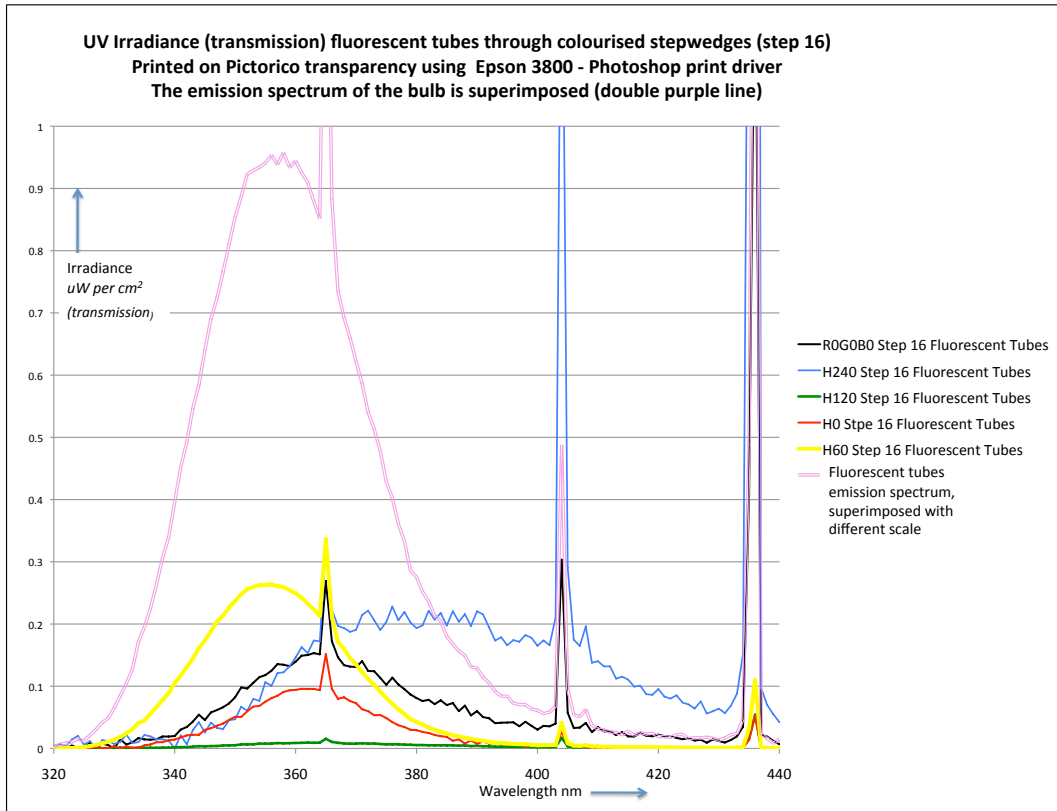


Figure A6.2.9

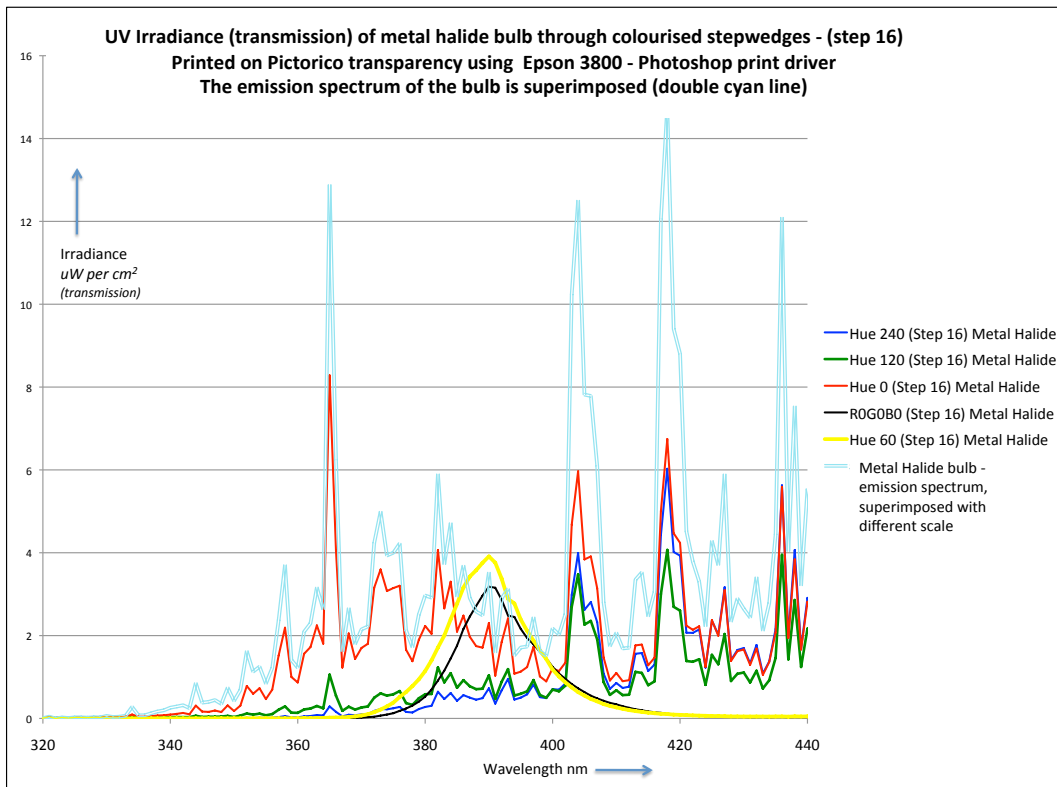


Figure A6.2.10

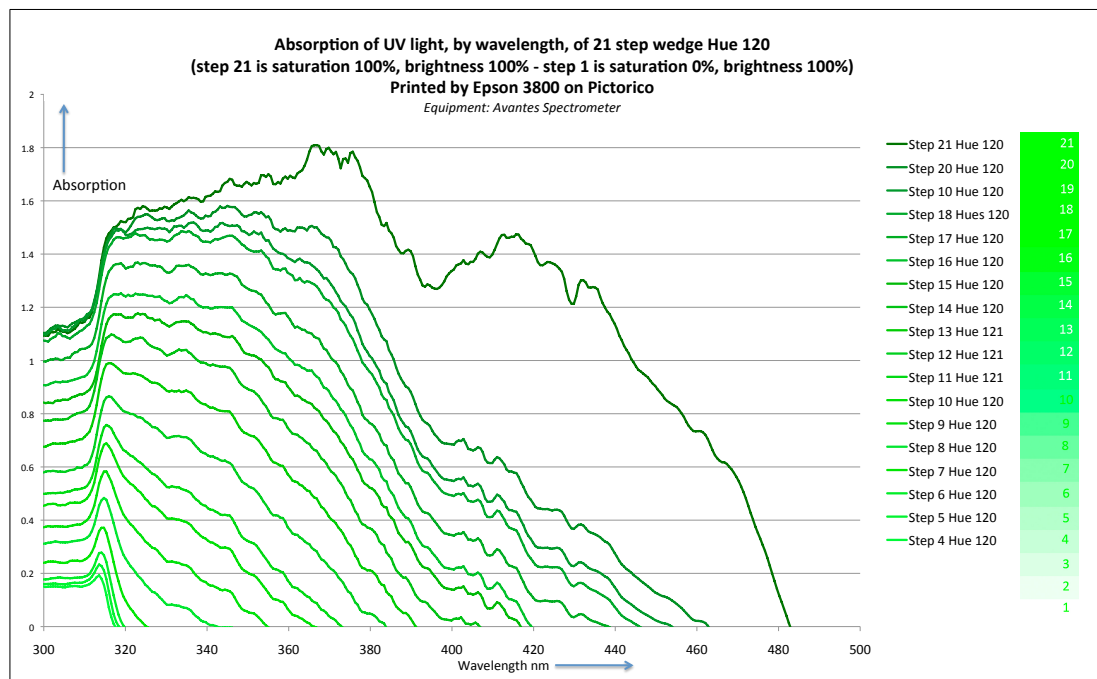
of UV sources. The two graphs above plot the transmission densities of Step 16 of colourised stepwedges to UV emissions for a metal halide bulb and from fluorescent actinic tubes. Under the metal halide bulb, *Figure A6.2.10*, above, the fluctuations in the transmission density of the red ink (Hue 0°), Blue ink (Hue 240°) and Green ink (Hue 120°) appears closely to match the emission spectrum of the bulb, with common peaks at 365nm, 382nm and 404nm. The variations in the densities of the yellow ink (Hue 60°) and black ink (R0G0B), however, do not correspond so directly, where their shared peak density at 390nm isn't replicated by the bulb emissions. With the fluorescent tube UV source, *Figure A6.2.9* above, the position is reversed; the blue ink (Hue 240°) does not map against the tube's emission pattern, but yellow (Hue 60°), black (R0G0B0), red (Hue 0°) and green (Hue 120°) inks closely follow the source's emission variations. What is happening here, what mechanisms are at work, is not immediately apparent. With mercury ballast and LED sources, the transmission densities of all inks map closely to the emission spectra of the bulbs, but certain inks show anomalous transmission variations with fluorescent and metal halide UV output. It is possible these 'anomalies' result from characteristics of the ink pigment molecules, though why yellow ink under metal halide emissions should give results at odds with the green and blue data when the blue and green inks are formed from a high component of yellow ink is unclear.

What is clear, though, is that the transmission of the energy of UV emissions through inkjet transparencies cannot be described by simple formulations. Within the key wavelength bands where the photosensitive chemistries are most reactive, the levels of transmitted energy are mediated, strongly in some circumstances and apparently idiosyncratically in others, by complex conjunctions of the UV source, the substrate, the composition of the inks, and the printer and software driver. Generalisations may be offered, for example, about the relative opacity of different inks, but these are liable to be contradicted when used with

different printers, produced on different substrates or exposed to different UV sources. They are unlikely, therefore, to provide *a priori* reliable recommendations for contact-printing practice. The following sections (A6.3 and A6.4) bring this practice into the investigations and examine the adaption of inkjet transparencies for operational printmaking processes.

A6.3 Inkjet transparencies and prints – linearisation and calibration

The previous sections evidenced the variable transmission of UV energy through inkjet transparencies and documented the unreliability of inkjet printers in producing either evenly increasing gradations of ink density across the full tonal range (illustrated for example, in *Figure A6.1.3*, above), or equal opacity across the key UV 350-410nm waveband (*Figure A6.2.7*, above). The following figure (*A6.3.1*), taking the example of green ink on Pictorico, articulates both these variabilities.



FigureA6.3.1

Absorption of UV light by wavelength - Hue 120

The absorption rates (basically, the reciprocal of transmission rates) of each density step on the stepwedge show decline with increase in UV wavelength and show inconsistencies in relation to the absorption of other density steps on the wedge. The vertical gaps between

the absorption rates of each step are not consistent – particularly noticeable with Step 21 and also with some of the mid and higher tones.

The practical use of inkjet negatives requires processes of adjustment to ensure that the UV transmission densities of the transparencies accurately and reliably produce the desired tonal articulations in the finished print. That is, to ensure the reflectance densities of the print – essentially, its tonal shades of darkness/lightness – are produced by the inkjet negative consistently to map the tones of the originating image. These processes are twofold: firstly, the '*linearisation*' of the ink deposition on the substrate to give even and consistent increases in transmission density across the whole tonal range; and, secondly, the '*calibration*' of the ink deposition density to match the photosensitive reactivity of the particular type of printing process and the UV exposure source employed. Techniques for *linearization* and *calibration* are examined in the subsequent section (A6.4). This section reports preparatory investigations into the relationships between the transmission densities of inkjet negatives and the consequential reflectance densities of the resulting prints.

For the initial investigations, a colour matrix (*Figure A6.3.2*, below) was produced as an inkjet negative on Pictorico through Photoshop using an Epson 3800 printer.⁴ An albumen print was prepared under the negative using fluorescent tubes as the UV source. A photograph of the resulting print is shown below (*Figure A6.3.3*), it illustrates the exposure responses to the differential UV transmission density of each of the 624 colourised squares of the matrix. The print reflectance density (X-rite 810) of the squares on each row is plotted against the print density (X-rite 361T), *Figure A6.3.4* below, producing a graph line for each row.

⁴ Colour matrix #1 was obtained courtesy of Michael Koch-Schulte (2007).

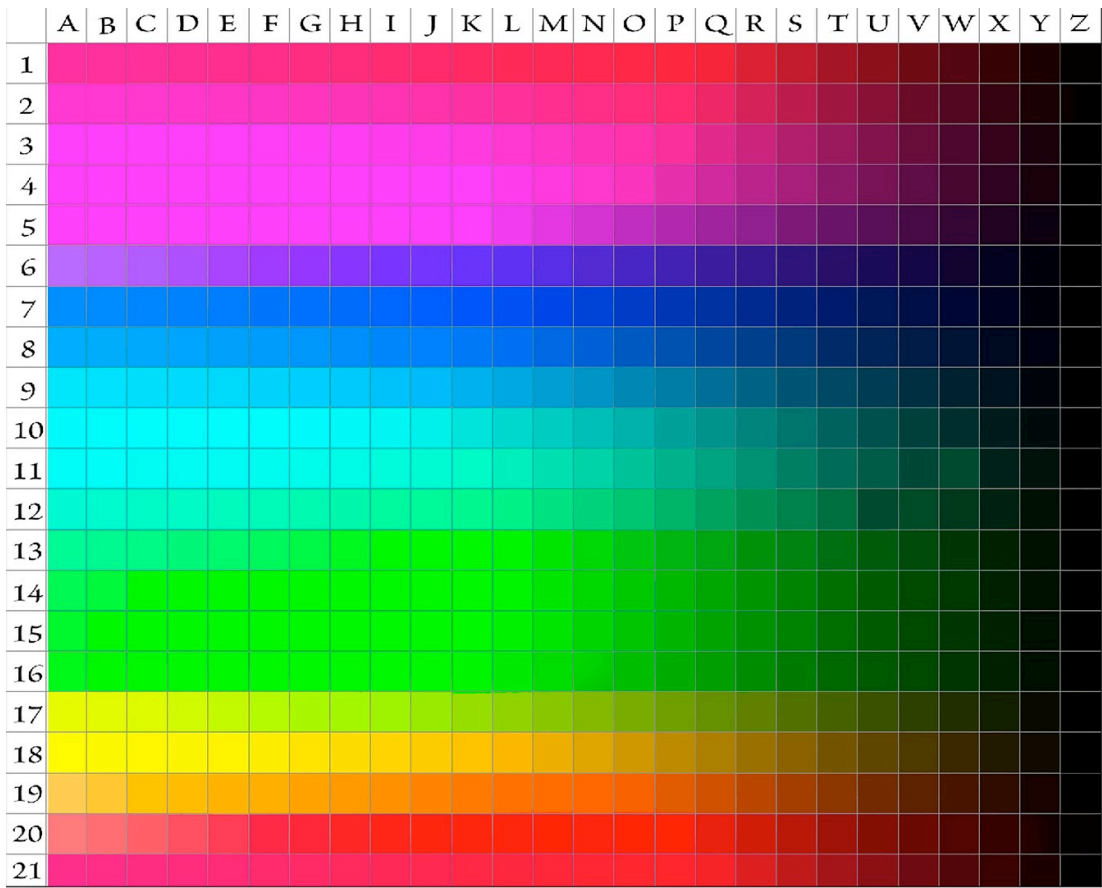


Figure A6.3.2

Colour Matrix #1

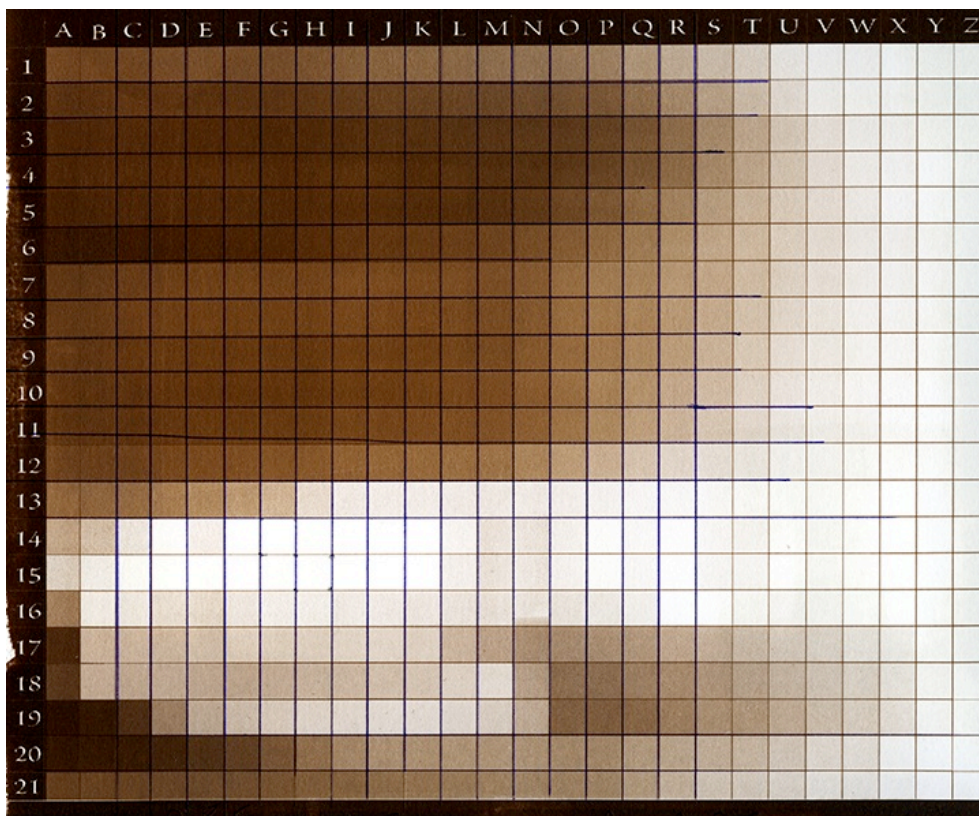


Figure A6.3.3

Colour Matrix #1 printed as Albumen

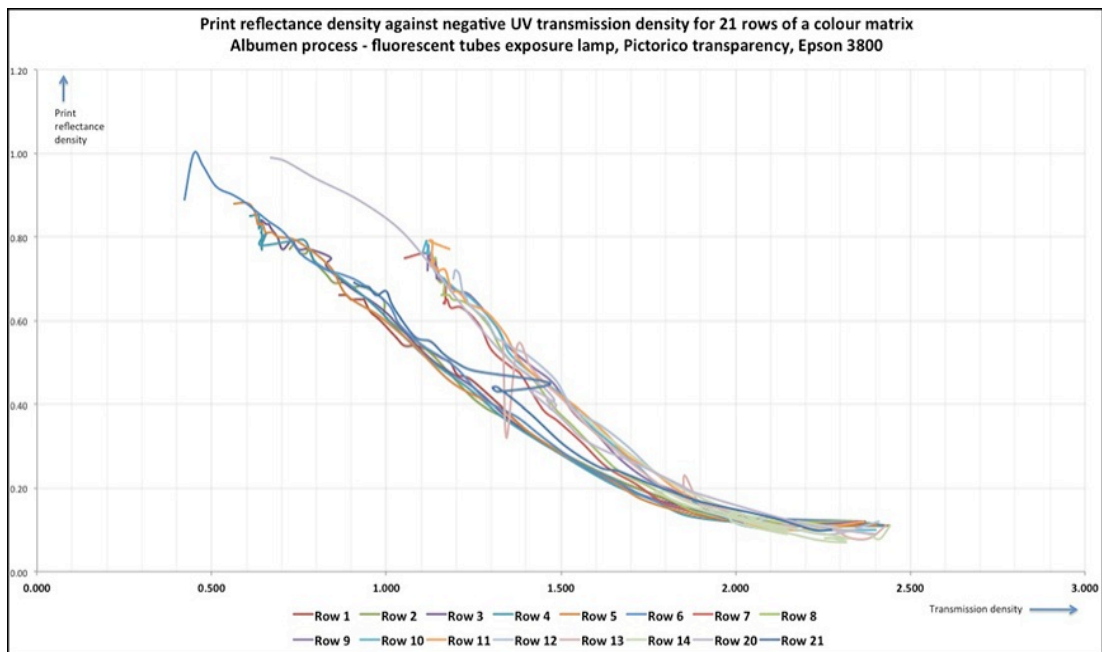


Figure A6.3.4 Albumen print reflectance densities for Colour Matrix #1

Although the precise position of each row's graph line is not easy to see on this busy presentation, the bifurcated nature of the results is clearly evident. Given an expectation that the equal measured UV transmission densities on the negative should produce reflectance densities that match one another, these are anomalous findings – some colours produce print density over twice that of squares with, apparently, the same opacity to UV. Similar bifurcations were evident with carbon transfer and cyanotype prints using the same negative, and repeated also in the salt print matrix, this time exposed under a metal halide bulb, that is shown below (Figure A6.3.5). This graph maps the points with markers rather than joins them with lines and it provides a clearer view of the spread of data. Again, the bifurcation is obvious – equal print reflectance densities are obtained with negative areas of very different transmission density, and areas of equal transmission density (as measured by the Xrite-361T densitometer) produce print areas of different reflectance density. This holds true with different UV sources and different print processes.

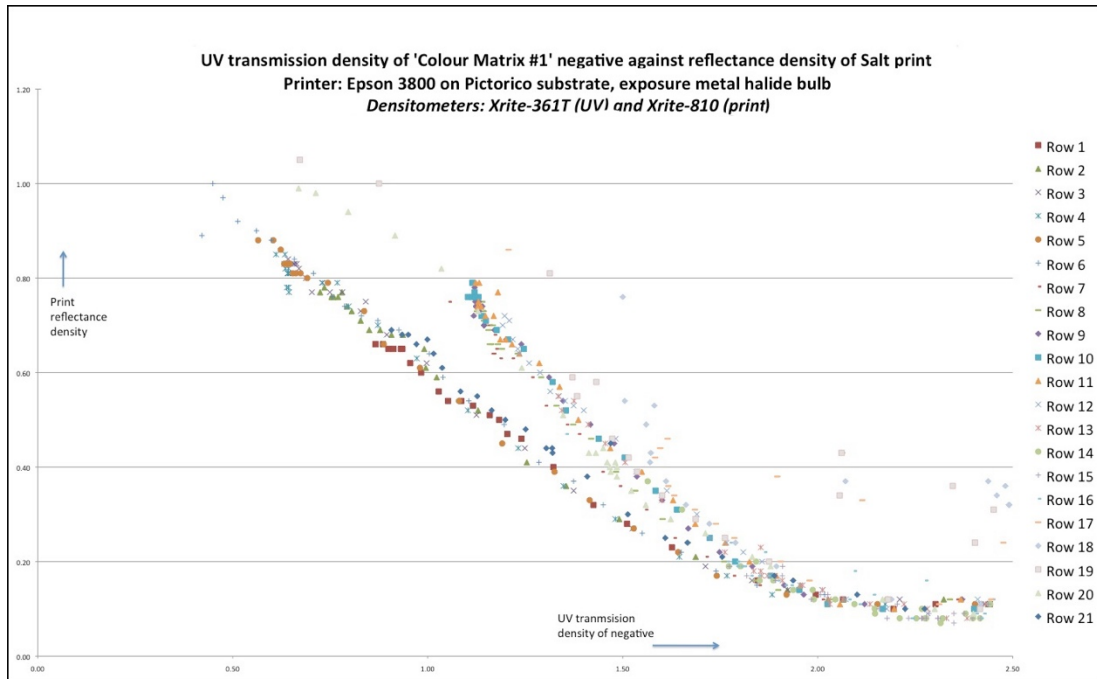


Figure A6.3.5 Transmission density against Salt print density - metal halide bulb

Colour Matrix #1 (*Figure A6.3.2*, above) did not prove to be suitable for further experimentation as the colour specifications along each row and column lacked systematic relation. A second matrix was developed (Colour Matrix #2, *Figure A6.3.6* below) in which Hues, at 15° intervals, are organised vertically and each Hue row has Saturation 0%, Brightness 100% through Saturation 100%, Brightness 100% to Saturation 100%, Brightness 0% in 21 increments of 10%. The hues, as specified from 100% fully saturated, with full 100% brightness down to 0% saturation, do not call upon any contribution from black cartridges and limit, therefore, the potential for unanticipated ink combinations with idiosyncratic consequences for print density. With Hues at 15° intervals the colour matrix provides 504 colour swatches (Hue 0° repeats itself at the full turn of the circle as Hue 360° at the bottom of the matrix). This can be increased to over 7000 colours, if necessary for differentiation, if all 359 hues are included, or increased, effectively without limit, using finer percentage changes in saturation and brightness. As a vehicle for specification and management of colours for inkjet negatives the HSB colour model appears sufficiently flexible and robust.

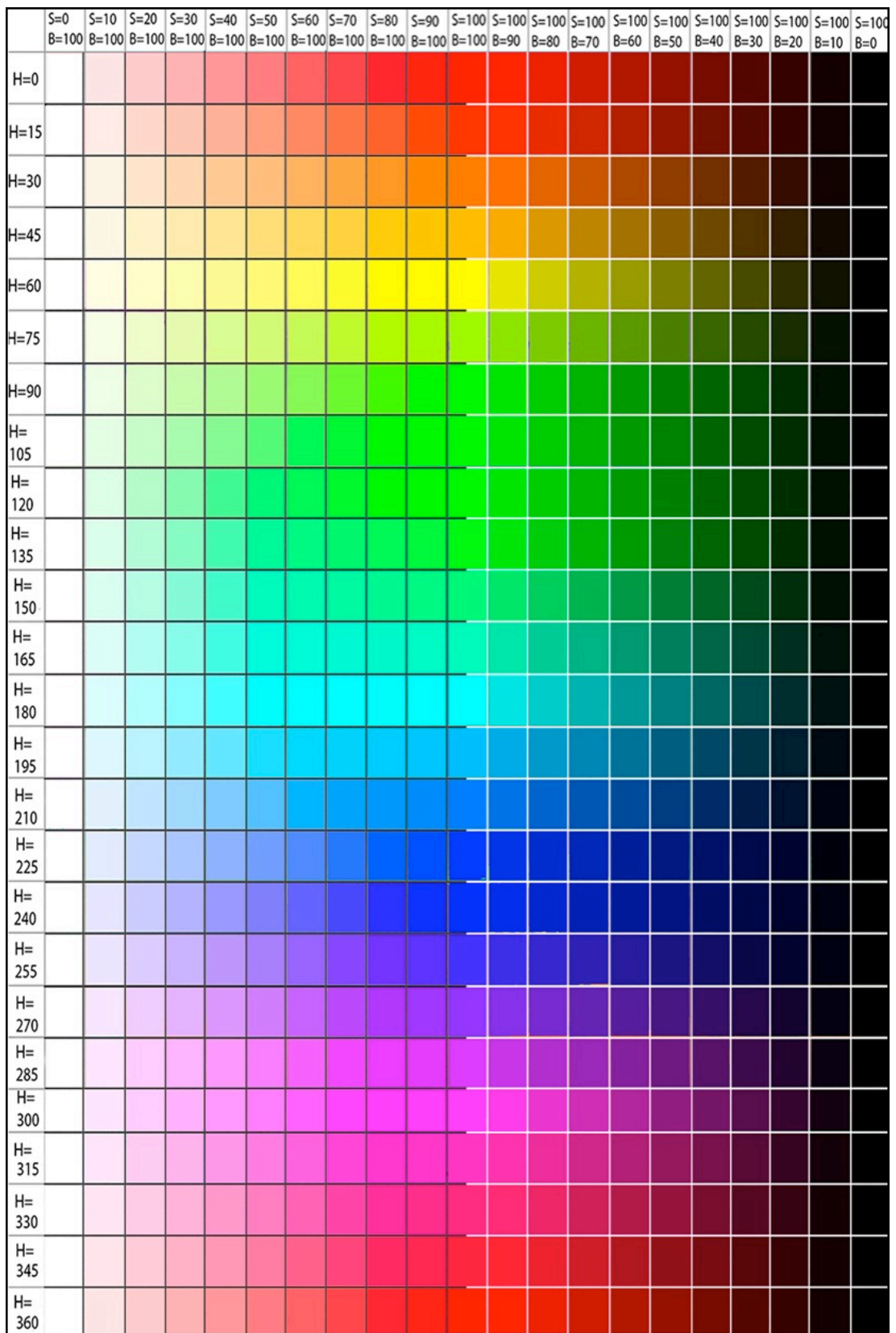


Figure A6.3.6

Colour Matrix #2

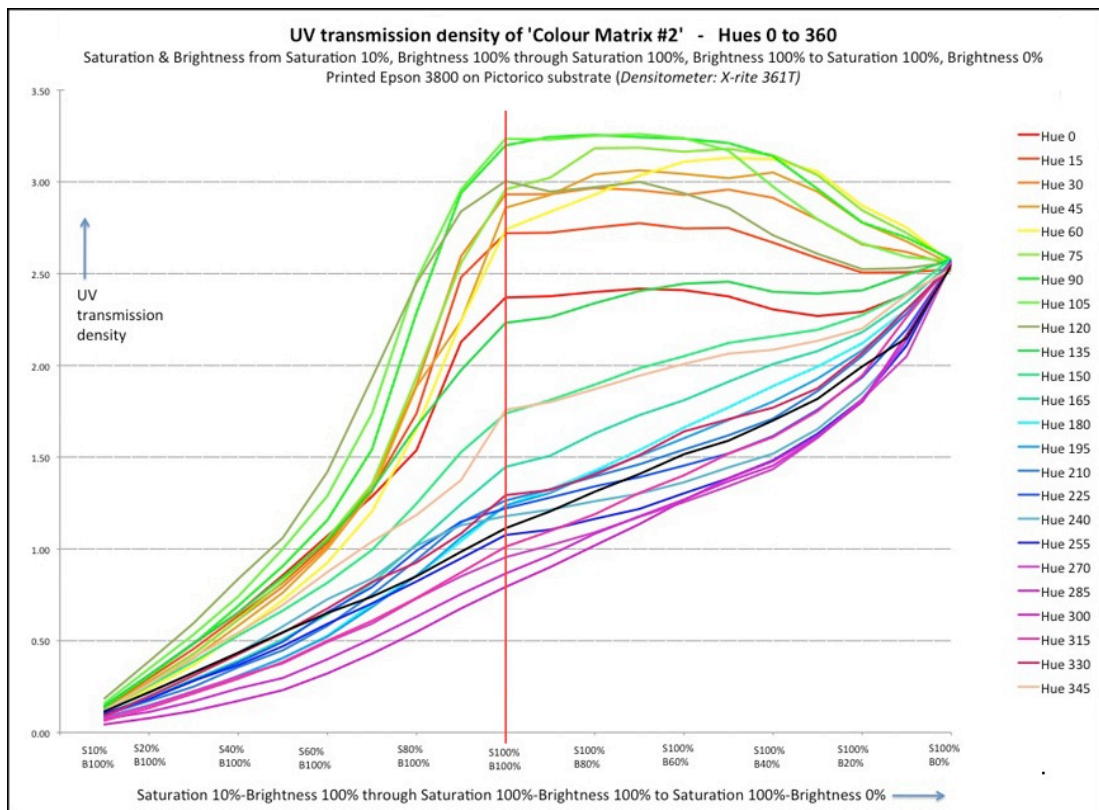


Figure A6.3.7

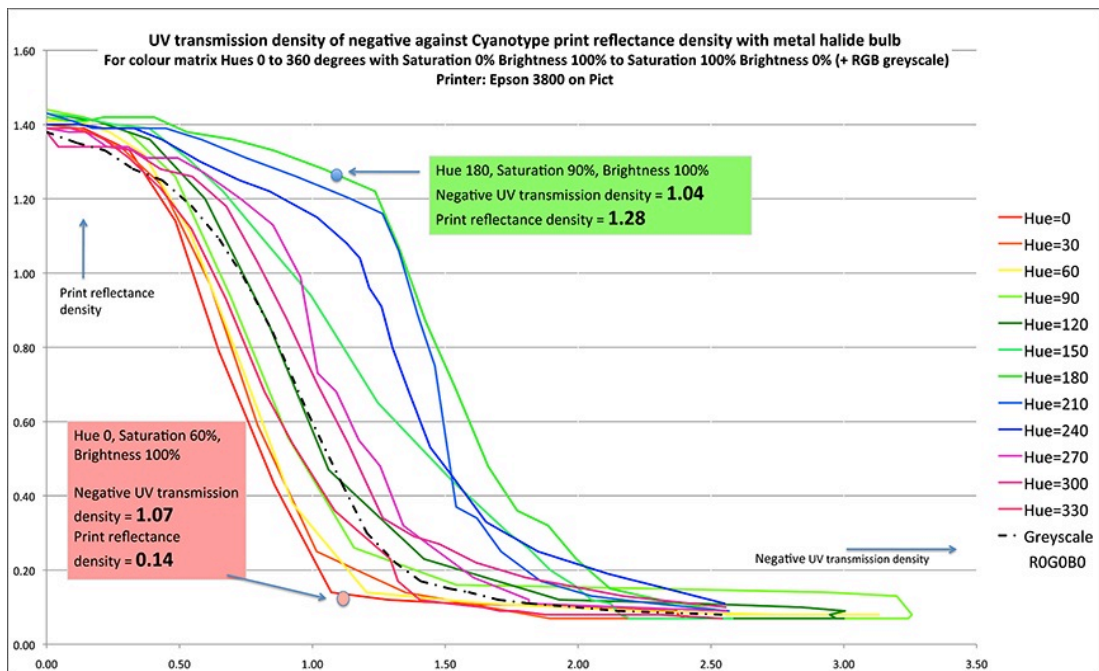


Figure A6.3.8

The UV transmission densities of each of the 504 swatches printed out on Pictorico transparency film are shown in *Figure A6.3.7*, above plotted for each Hue. The graph demonstrates the effect, particularly noticeable with green hues, that UV transmission density can drop, once the Brightness percentage starts to decline, as black ink is added to the colour mix. The data also indicate the 'linearity' or evenness of UV density increases for each Hue. The blue/purple and purple hues plots more closely approximate straight lines, though they may lack the UV opacity necessary for some processes such as carbon transfer, platinum and salt printing where long scale tonal range in the negative is required.

Colour Matrix #2 was used to produce a Cyanotype print, using a metal halide UV source and the reflectance densities of the print plotted against the UV transmission densities of the negative, repeating the exercises completed earlier with Colour Matrix #1 (*Figures A6.3.4 & A6.3.5*, above). Because of the revised method of structuring the colour displays, the results with the revised matrix appear more intelligible, though not necessarily explicable. *Figure A6.3.8*, above, plots the transmission densities of the negative by HSB (as measured by X-rite 361T densitometer), against the reflectance densities (as measured by X-rite 810) of the cyanotype print. The relationship, for each Hue, between the opacity of the colour transparency and the resulting tones of the print are evident. The plot lines of each Hue are coherent, relatively smooth, clearly differentiated – and puzzling.

Two Hue lines on the graph can be taken to exemplify the issue. Hue 180° (green), at any given level of UV opacity, produces a much darker density of print than Hue 0° (red). For example: at a UV density of 1.04, Hue 180° produces a print density of 1.28, but Hue 0° at an equivalent UV transmission density of 1.07 gives a print density of only 0.14. Hue 180° is less effective at blocking the UV energetic emissions, Hue 180° requires a density of 2.5 before it achieves an equivalent opacity – that is 5 stops extra in camera exposure terminology. The answer to this anomaly may lie, in part, with the type of transmission densitometer being

employed for the measurements – an X-rite 361T. *Figures A6.2.2 and A6.2.4, above, show that the different peak wavelength sensitivities of three densitometers do produce different transmissions density readings. However, the X-rite-361T densitometer is regularly calibrated and the differences between Hue 0° and Hue 180° are so large that it is possible but unlikely simply to be an equipment issue.*

To explore this further, the transmission and reflectance density reading for a cyanotype print produced with an inkjet negative with colour swatches of hues at 15-degree intervals, all at saturation 100% and brightness 100%, are shown in *Figure A6.3.9, below. A similar*

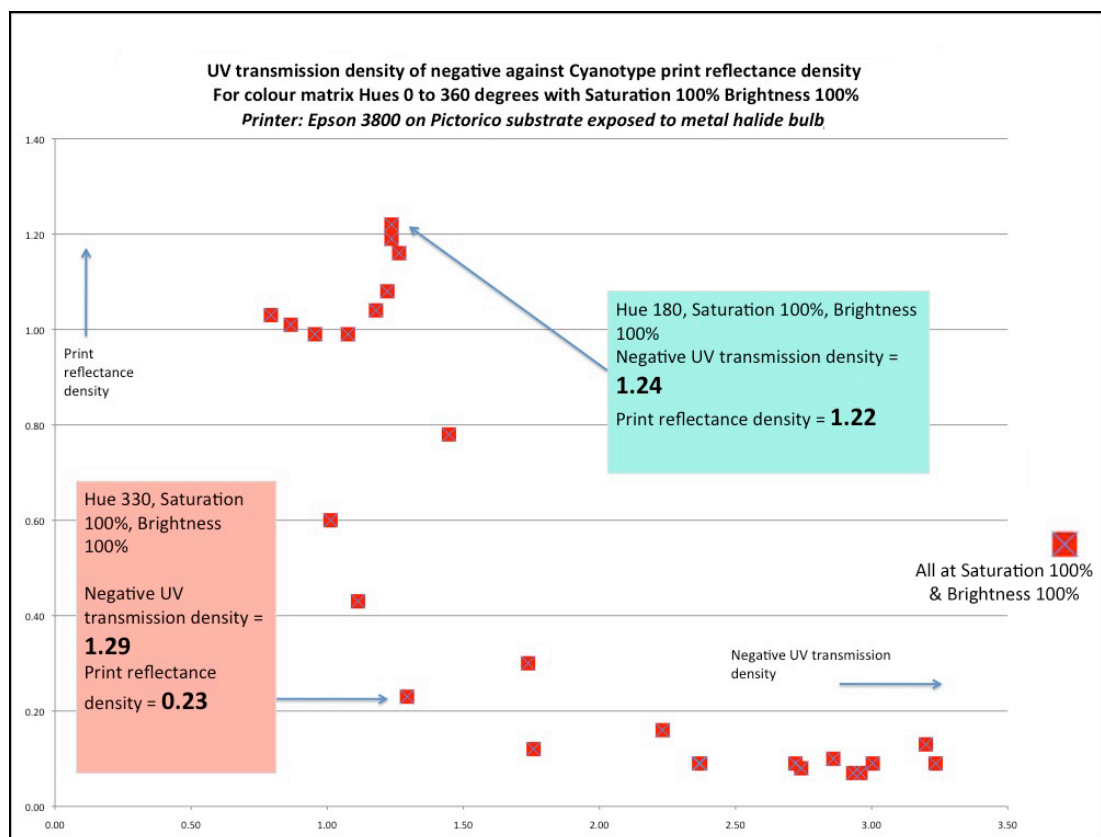


Figure A6.3.9

anomalous pattern is evident. Hue 180°, with a transmission density of 1.24, allows enough UV exposure to produce a print density of 1.22, whilst Hue 330° with similar transmission opacity is very effective at blocking UV transmission and allows the production of a print density of only 0.23. Further experiments were undertaken to determine whether these

'anomalies' were specific to particular conjunctions of process/UV source/ink combinations.

The following four figures (A6.3.10 – A6,3,13) present data in respect of the print density

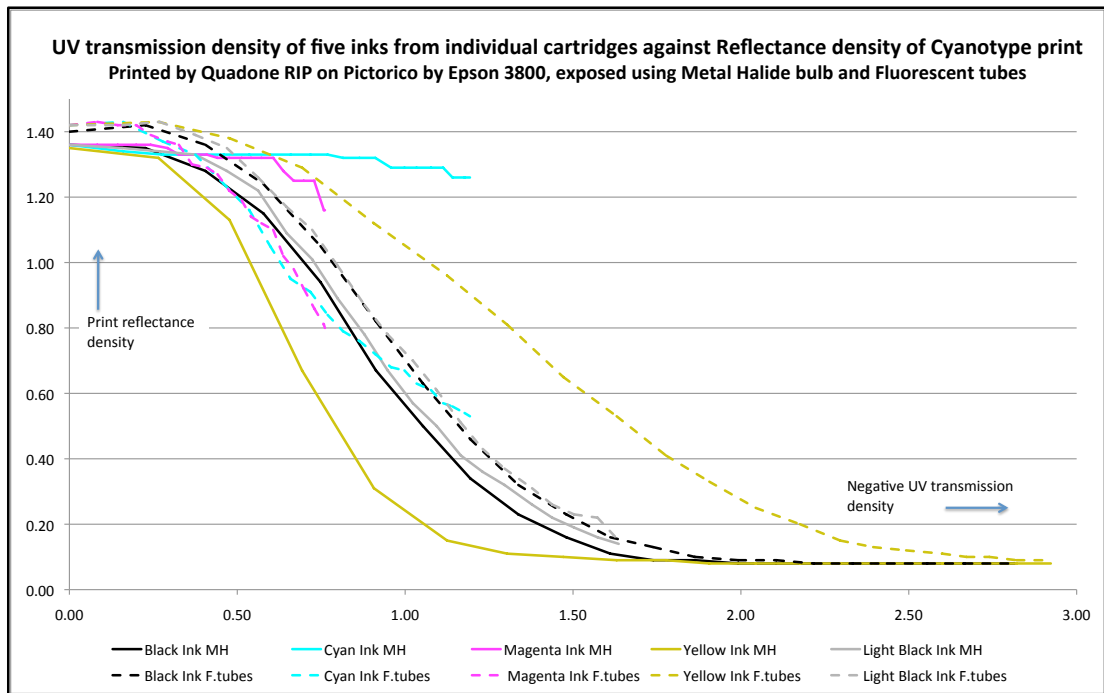


Figure A6.3.10

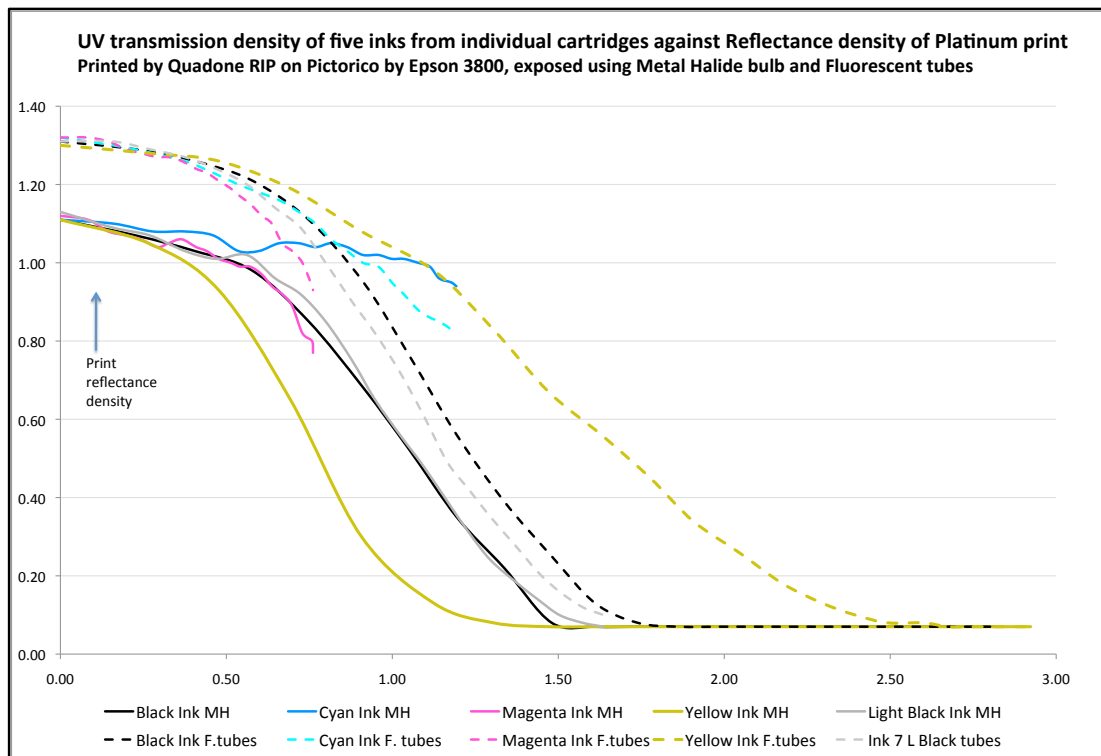


Figure A6.3.11

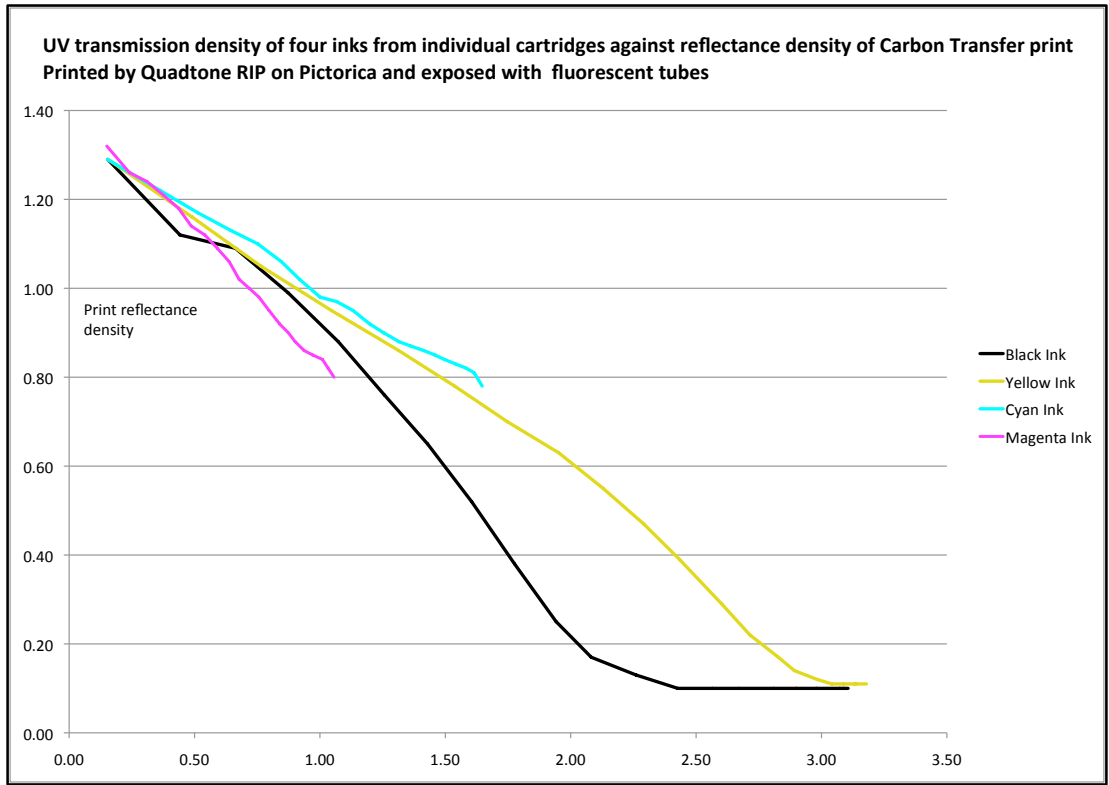


Figure A6.3.12

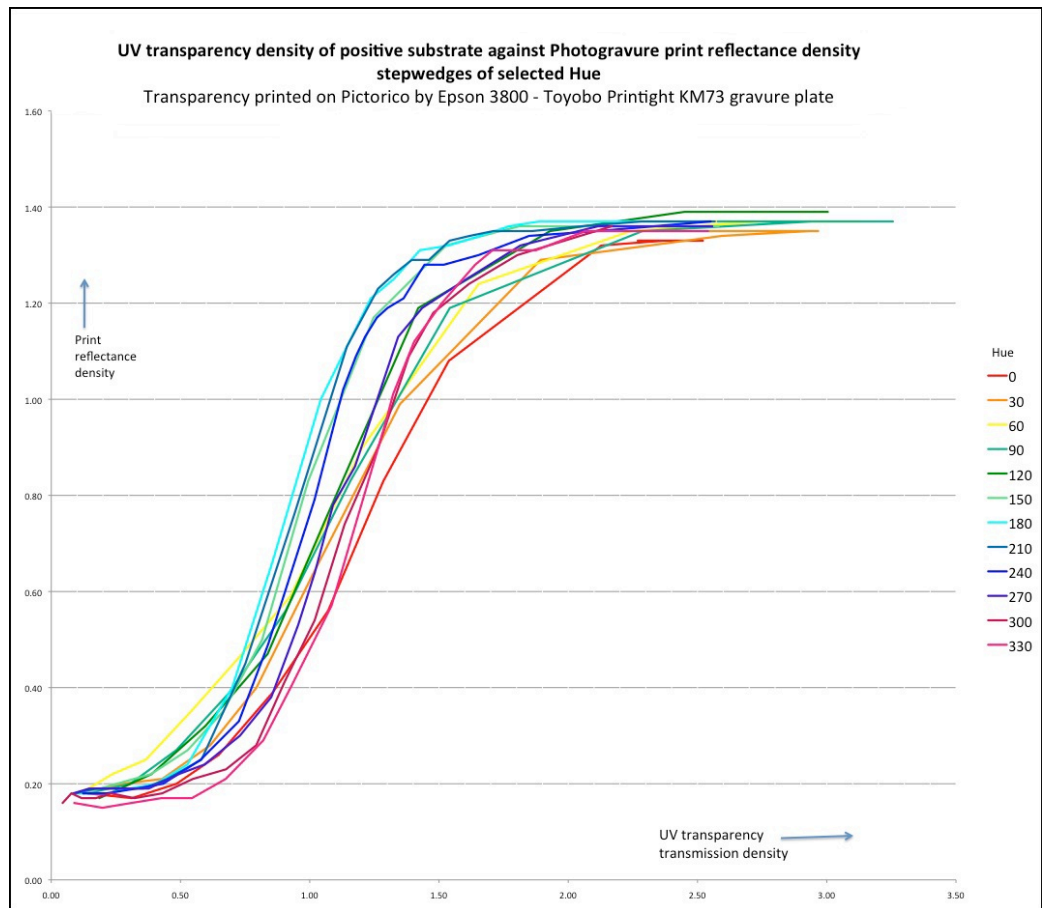


Figure A6.3.13

of cyanotype, platinum, photogravure and carbon transfer processes in relation to the UV transmission density of stepwedge inkjet negatives printed through Quadtone RIP (i.e. only inks deposited from individual cartridges) and Photoshop drivers (i.e. ink mixed from various cartridges). There is evidence that the UV transmission density of the negative – as measured by X-rite 361T densitometer – has no immediately discernible or consistent relationship with consequential print density. With measured UV transmission density of the negative held constant, print reflectance density varies, apparently idiosyncratically, according to both ink colour and UV source.

Of particular interest for the adaption of inkjet technologies for contact printing is not only the gross differences in density by negative opacity, but the rate of change in print density/negative opacity as opacity increases – that is, the slope of what in this context might be called the *contrast curve*, the digital equivalent of the Hurter & Driffield exposure curve – is potentially very important for maximising print resolution and tonal differentiation. The hypothesis runs as follows. Significant alteration of the tonal articulation of the image file is required in order to correct for the inability of inkjet printers to provide linear and even increases in negative transmission densities (see, for example, *Figure A6.1.3*, above) and these alterations necessarily compress and distort the tones of the original image and may result in digital artefacts and poor tonal articulation that appear as defects in the final print. The shallower the curve – UV density plotted against print density – the longer the range of negative densities over which the sensitised print is receptive to UV energy and the less the original image file needs to be compressed and distorted to fit within that envelop. Other things being equal, therefore, greater control over print appearance comes from the use of negative colours and UV sources which require the longest range of negative UV transmission density to effect a full print density range from D_{\min} to D_{\max} . The following section considers

this hypothesis in the context of the linearisation and calibrations techniques necessary for the employment of inkjet negatives.

A6.4 Inkjet negatives - linearisation and calibration

Without prior compensatory adjustments, the tonal differentiation of inkjet negatives is unlikely to provide for even and consistent gradation across the full density range, as evidenced in *Figures A6.1.3* and *A6.1.6*. Various techniques have been adopted to overcome this, but all are based on methods that relate the transmission density of the printer output to the on-screen 'greyscale-density' (or Photoshop levels) of the originating image – usually a stepwedge – and the consequential adjustment of the digital file specification on-screen in order to produce the output density required (Koch-Schulte, 2007; Harmon, *n.d.*; Nelson, *n.d.*). For example, if Step 11 of a 21 Step greyscale wedge prints out on a transparency substrate with a measured UV transmission density of 1.20 and the minimum and maximum transmission densities of the printed wedge are 0.05 and 2.05, respectively, then Step 11 (the mid-point on the stepwedge) should print out with a density of 1.00 to ensure an even expression of tonal gradation. To rectify the inadequate density of Step 11, the image of origination is adjusted on screen and its tones lightened until Step 11 prints out on the substrate with a density of 1. Additional adjustments may be required for every step of the stepwedge where its output on the substrate does not correlate with its relative position on the origination image. Within Photoshop, the most commonly employed technique for these changes is the 'Curves Adjustment Layer' that can store and apply a mathematically determined and graphically articulated moderation differentially to all levels or densities of the original image.

Figure A6.4.1, below, shows a presentation of a Curve Adjustment Layer that illustrates the relationship between the 'input' specification of the densities of the original image and the 'output' specification of the adjusted (distorted) image.

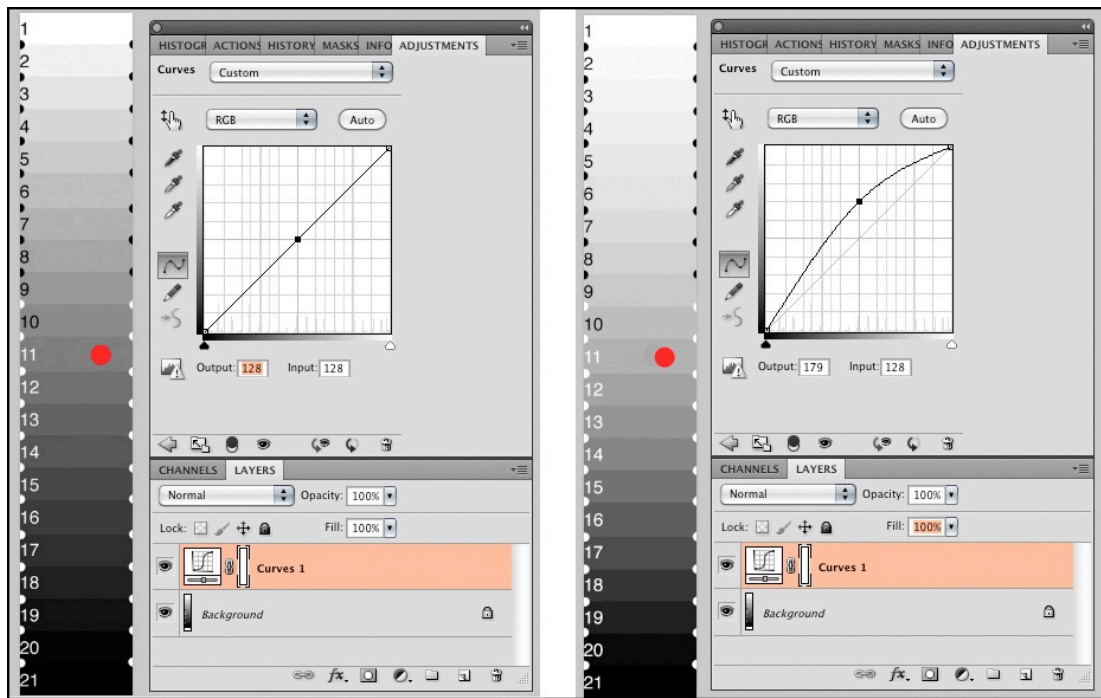


Illustration A6.4.1

The 'origination image' is the Stepwedge on the left on both of the illustrations. Its tonal mid-point, Step 11, is marked with a red circle. The Curve Adjustment Layer is shaded rectangle in pink/brown, towards the bottom right of each of the two images, and the graphical expression of the adjustments is shown upper-right. On the left, the input – Photoshop level 128 – matches the output, level 128. On the right-hand illustration, the input (i.e. the original Step 11), remains at 128 but the output is increased to level 179. This is a lighter tone than level 128 (level 0 is black, level 255 is white) and in consequence, when the stepwedge is printed out, the transmission density of Step 11 will be reduced. Table A6.4.2, below, presents a worked example of linearisation. The 21 steps are listed under Column A. Column B records the measured UV transmission density of the Stepwedge printed as inkjet transparency – its mid-point, Step 11, has a density of 0.84. Column C shows the calculated

Column A	Column B	Column C	Column D	Column E	Column F
Step wedge	Measured UV transmission density of first negative printout	Density value needed to secure even gradation	Calculated: The Step With Correct Density	Photoshop Curve INPUT Values	Photoshop Curve OUTPUT Values required to produce linearised stepwedge
1	0.15	0.15	1	255	255
2	0.19	0.21	2	242	242
3	0.33	0.27	3	230	232
4	0.41	0.33	3	217	218
5	0.46	0.38	4	204	193
6	0.55	0.44	5	191	177
7	0.61	0.50	5	179	160
8	0.69	0.56	6	166	139
9	0.72	0.62	7	153	129
10	0.79	0.68	8	140	115
11	0.84	0.74	9	128	105
12	0.92	0.79	10	115	87
13	0.94	0.85	11	102	78
14	1.00	0.91	12	89	66
15	1.03	0.97	13	77	57
16	1.08	1.03	15	64	47
17	1.12	1.09	16	51	34
18	1.14	1.14	18	38	25
19	1.19	1.20	19	26	20
20	1.26	1.26	20	13	15
21	1.32	1.32	21	0	0

Table A6.4.2

densities that each step should exhibit if the print-out was linearised and there was an even increase in density across all 21 steps; the density needed for Step 11 is 0.74 (mid-way between 0.15 and 1.32). Column D looks for the Step that actually achieved the density required for Step 11, and this is Step 9 with a density of 0.72, more or less the density that Step 11 should show. Finally, Column F calculates the 'Curve Adjustment Layer' output value (level 105) required for the Step 11 Input level of 128 in order that on the printed stepwedge it will produce precisely the correct mid-tone transmission density value of 0.84. For the complete linearisation process, the Curve Adjustment Layer should include all the amended Output levels for each of the Input levels shown in the table above. *Illustration A6.4.3*, below, illustrates a typical Curve Adjustment Layer required to linearise the printed output of an inkjet negative. Each Output level is amended individually, only Level-0 and Level-255 remain

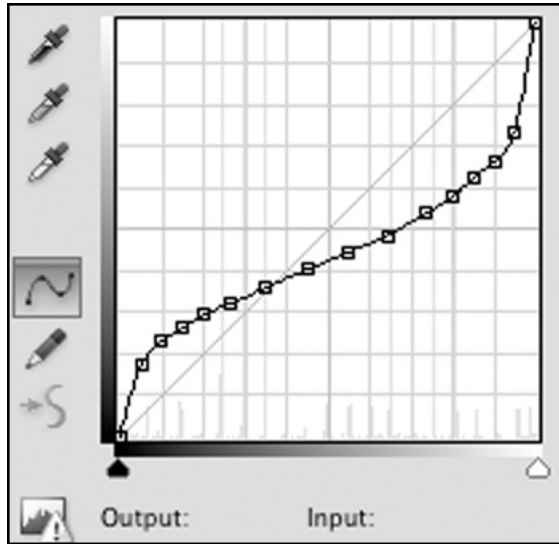


Figure A6.4.3

as fixed points. Whilst the process of linearisation can be time-consuming, once the Curve Adjustment Layer has been calculated, it can be stored and used repeatedly without further amendment provided the printing process and UV source remain the same.

Linearisation compensates for the inkjet printer's difficulty in printing evenly gradated tones on transparency film. Illustration A6.4.4, below, is an illustration of linearised stepwedges where the UV transmission density increases evenly and equally across the 21 steps of each

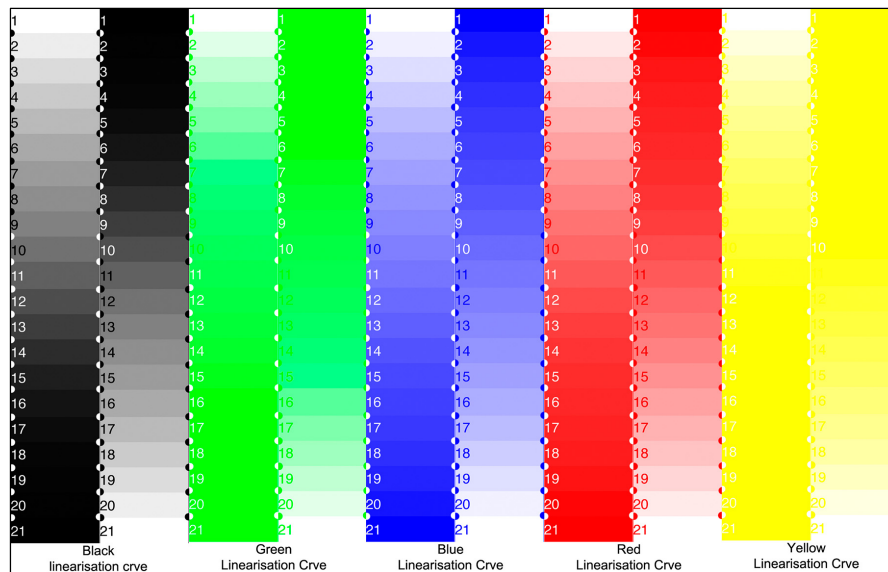


Illustration A6.4.4

Five examples of coloured and linearised stepwedge negatives. In RGB and HSB terms: the black wedge is 0,0,0 (H0,S0,B0); green is 0,255,0 (H120,S100,B100); blue is 0,0,255 (H240,S100,B100); red is 255,0,0 (H360,S100,B100) and yellow R255,G255,B0 (H60,S10,B100)

colourised wedge. The curve adjustments implemented through Photoshop to produce linearised inkjet transparencies are different for each type of substrate and for each printer/ink combination. The Epson 3800 printer, for example, required quite distinct curve adjustments from the Epson 3880 even though they share basically the same components. They use different Magenta inks, however, their printer heads respond differently, and in consequence required different linearisation curves.

'*Calibration*' is a second stage adjustment process and is necessary to compensate for any failure of the photosensitive chemistry to respond equally to equal increases in the transmission density of the negative, the equivalent of the extended toe or shoulder of many film and wet chemistry development processes. Calibration is achieved through the same techniques used to secure linearisation. That is, the reflectance density of a contact-printed stepwedge, using the linearised inkjet negative, is evaluated against the print reflectance densities required for even tonal gradation. An additional Curve Adjustment Layer is then calculated to further compensate for each Step where the print density does not accord with that required. Linearisation and calibration, therefore, necessitate two alterations of the tonal differentiation of the original image file in order for the final print to display the tones that the image author intended. The two Curve Adjustment Layers may be combined into a single linearisation/calibration curve to simplify work-flow, but this does not obviate the necessity for the dual alterations to the original image.

Depending on the printer and its inks, the substrate, the UV source and the chemistry of the printing process, the linearisation adjustments that must be applied can be severe. *Illustration A6.4.5*, below, is an example of a high-key and low-key test piece combined with stepwedges, shown for convenience of illustration as a positive image, rather than as a negative. Where a severe compensation Adjustment Layer Curve has been applied,

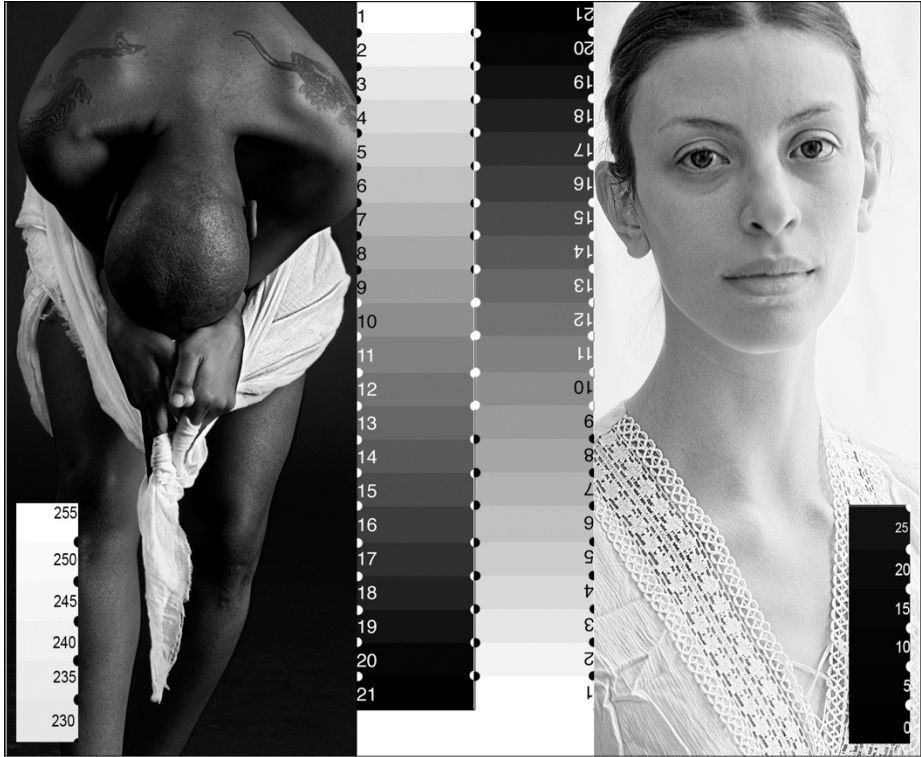


Illustration A6.4.5

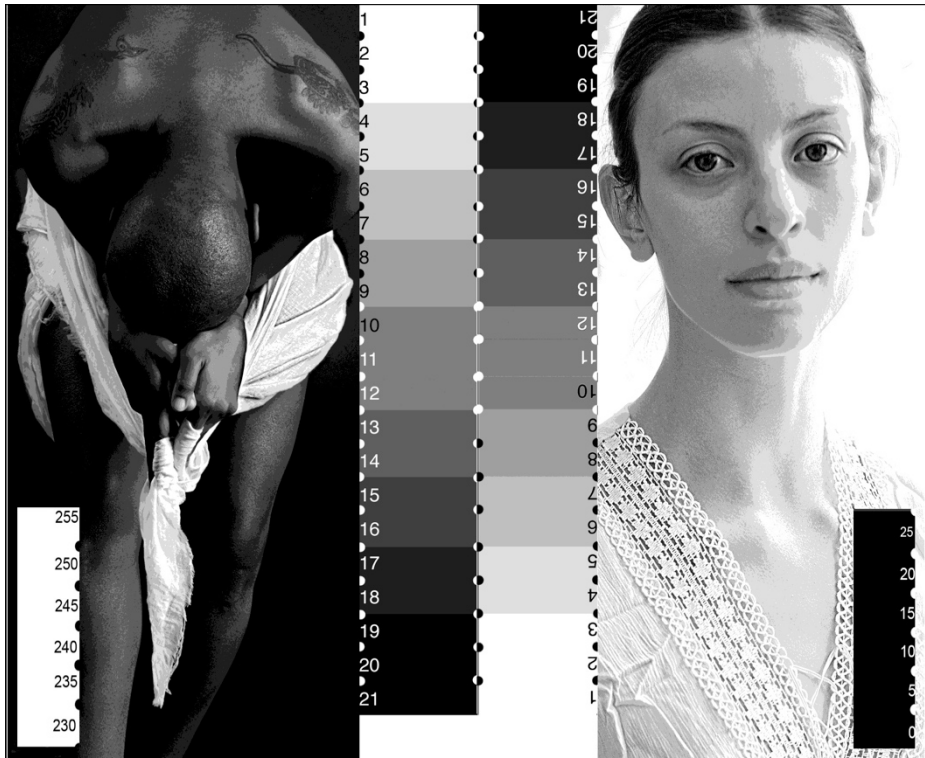


Illustration A6.4.6

Illustration A6.4.6 above, the original image becomes so distorted that ‘posterisation’ occurs where the tonal changes are abrupt, the quality of the image is damaged and the negative will not print to an acceptable standard.

All tonal change, in the cause of linearisation and calibration, has the potential to degrade the quality of the original image file. Given a good quality image in the first place (i.e. a 16bit image with a large number of pixels) the degradation may appear modest and remain undetected when the print is observed at normal viewing distances. It is always desirable, however, to minimise the scale of these adjustments and to that end, the results of the investigations, reported above *Section A6.2*, into the differential opacity to UV energy of various ink/lamp combinations may usefully be exploited to minimise the compensatory digital ‘degradation’ of images that is required in order to produce the ‘best’ inkjet negatives. The apparently ‘anomalous’ findings that colourised negatives of the same UV transmission density produce prints with equivalent reflectance density, and *vice versa*, provide information that allow choice of ink colour and UV sources that demonstrate the ‘least worst’ impact on the origination image.

To illustrate the basis for these choices, further examples of the relationships between UV transmission density and print reflectance density are reported below. As a sample, four green and yellow stepwedges were selected based on their UV opacity and exposed under four UV sources to platinum and cyanotype coated substrates. The results are shown in the graphs below (*Figures A6.4.7, A6.4.8, A6.4.9 and A6.4.10*) and show the relationships between negative UV transmission density and resultant print reflectance density. Judging by the slope and placements of these data on the graphs, they do not indicate a consistent moderating relationship between either negative colourisation and print density or UV source and print density, but they do imply significant ‘interference’ in the causal relationship between negative opacity and print resultant density. The varied slopes on the

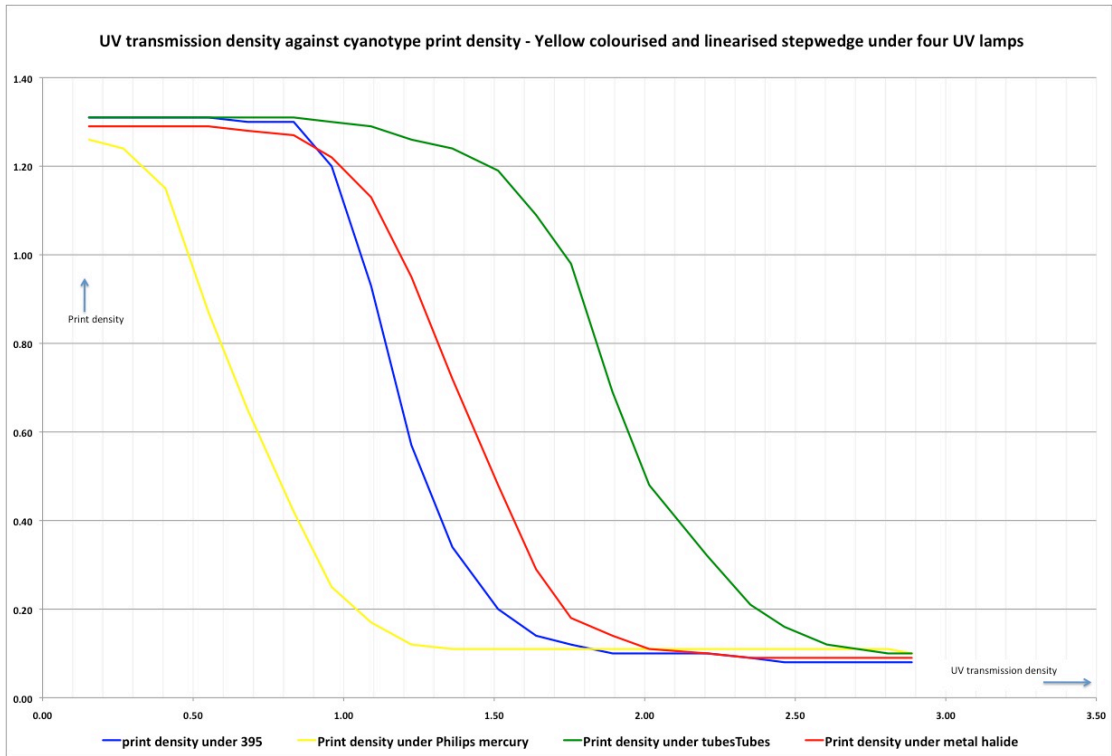


Figure A6.4.7 UV density plotted against Cyanotype print density – yellow negative, 4 lamps

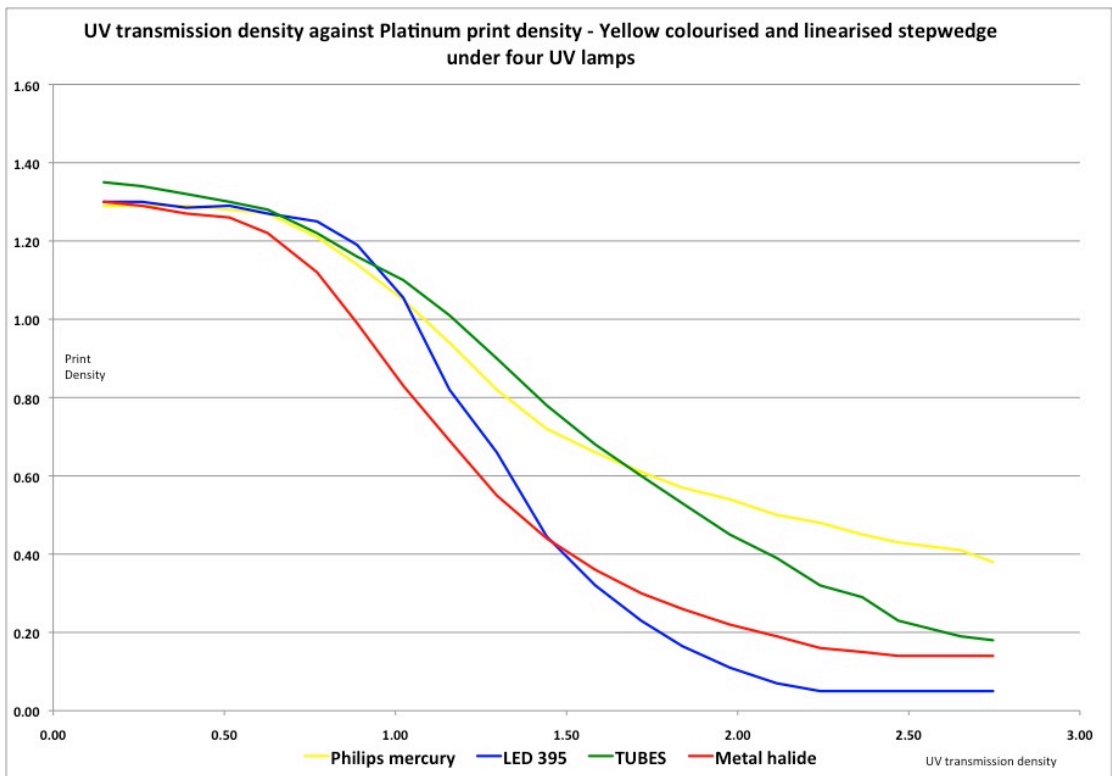


Figure A6.4.8 UV density plotted against Platinum print density – yellow negative, 4 lamps

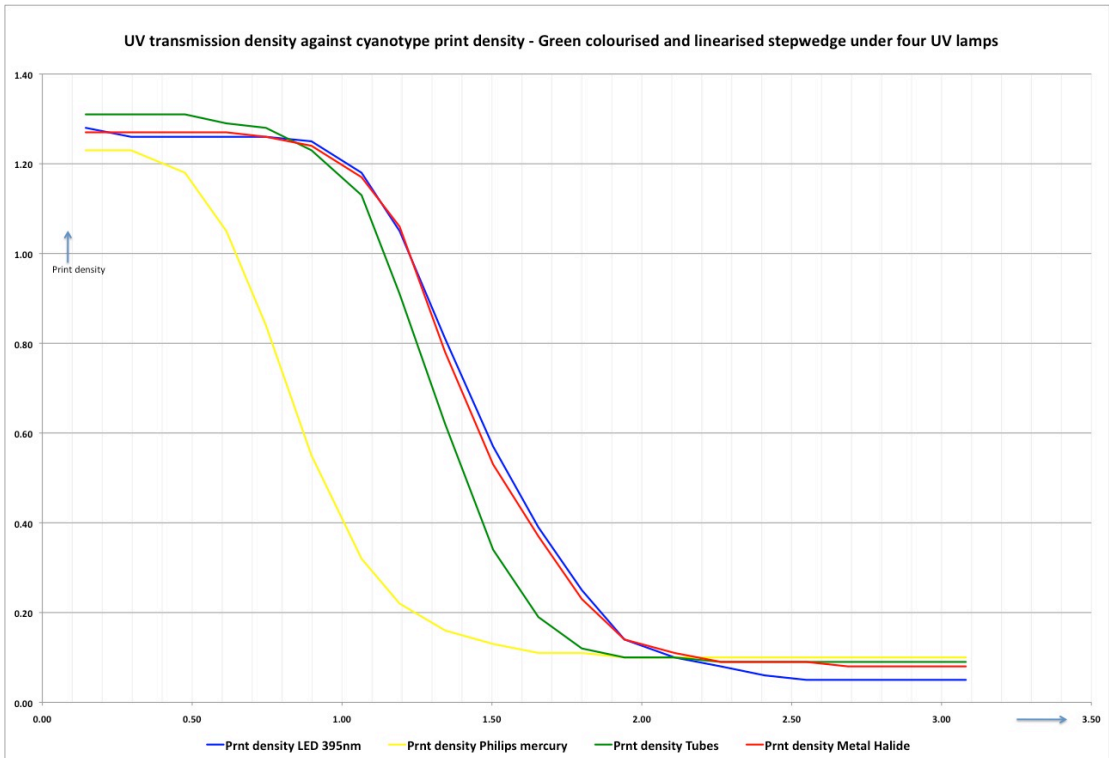


Figure A6.4.9 UV density plotted against Cyanotype print density – green negative, 4 lamps

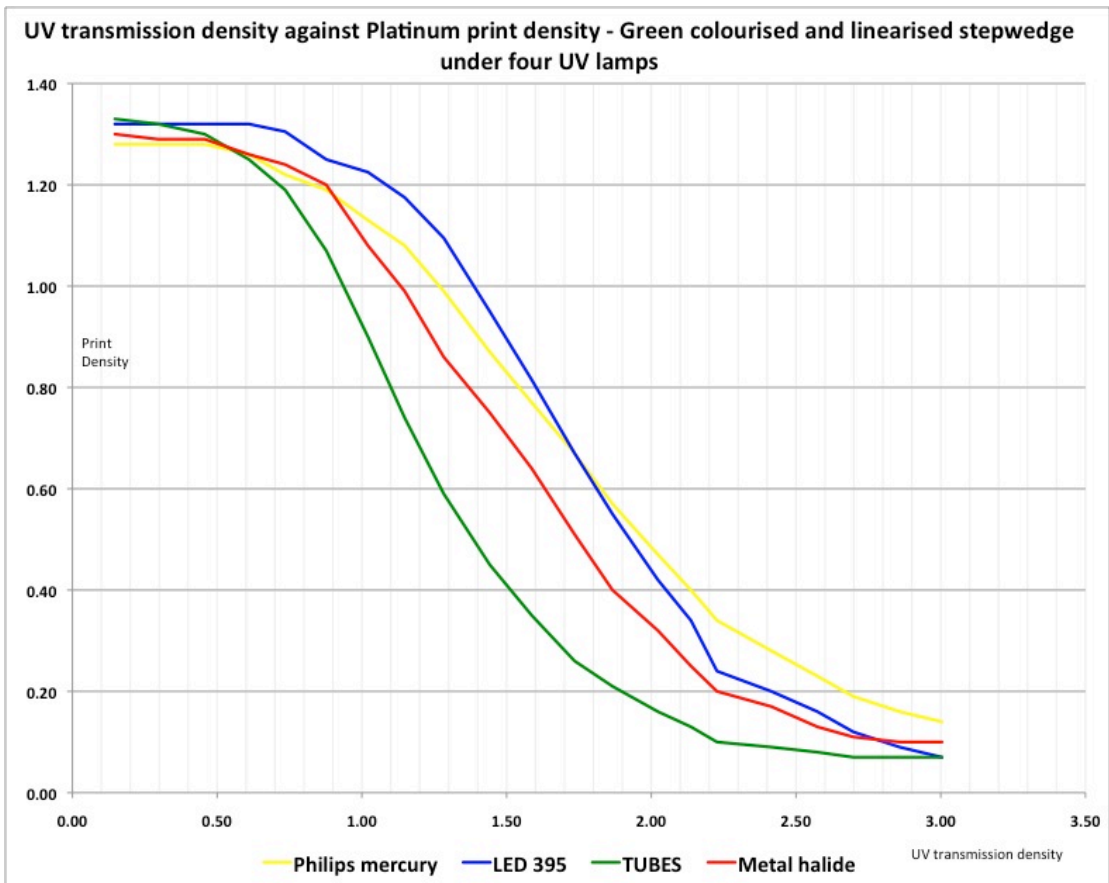


Figure A6.4.10 UV density plotted against Platinum print density – green negatives, 4 lamps

graphs suggest exposure by different lamps through differently coloured negatives may impact upon the contrast, tonal differentiation, and perhaps acutance, of the resultant print, though the parameters of those effects are unclear and perhaps inconsistent.

Each figure above present the data in respect of the colour of the negative, the two examples below (*Figures A6.4.11 and A6.4.12*) show the variation in print density primarily by reference to the light source. Except for the blue stepwedge, which appears somewhat of an outlier, the slopes (and hence print contrast) of the data for the different colours under the LED lamp are not markedly different, but the toe and shoulder areas of the curves suggest different articulations of shadow and highlight tones. *Figure A6.4.12*, below, presents the comparative data for cyanotype process under four coloured stepwedges with fluorescent tubes UV source (because of it's modest opacity, the blue stepwedge could not be included). Although there are similarities in terms of the overall placement or order of the

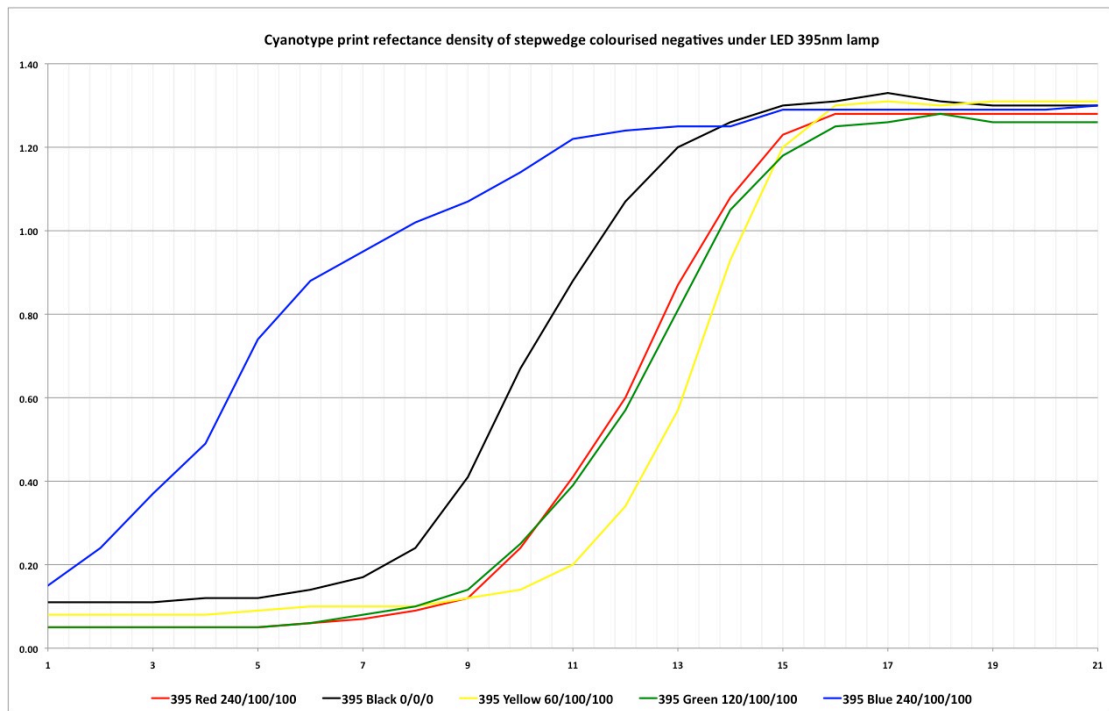


Figure A6.4.11 Cyanotype print densities of colourised stepwedges under LED UV
 cyanotype print density of colourised negatives under LED array

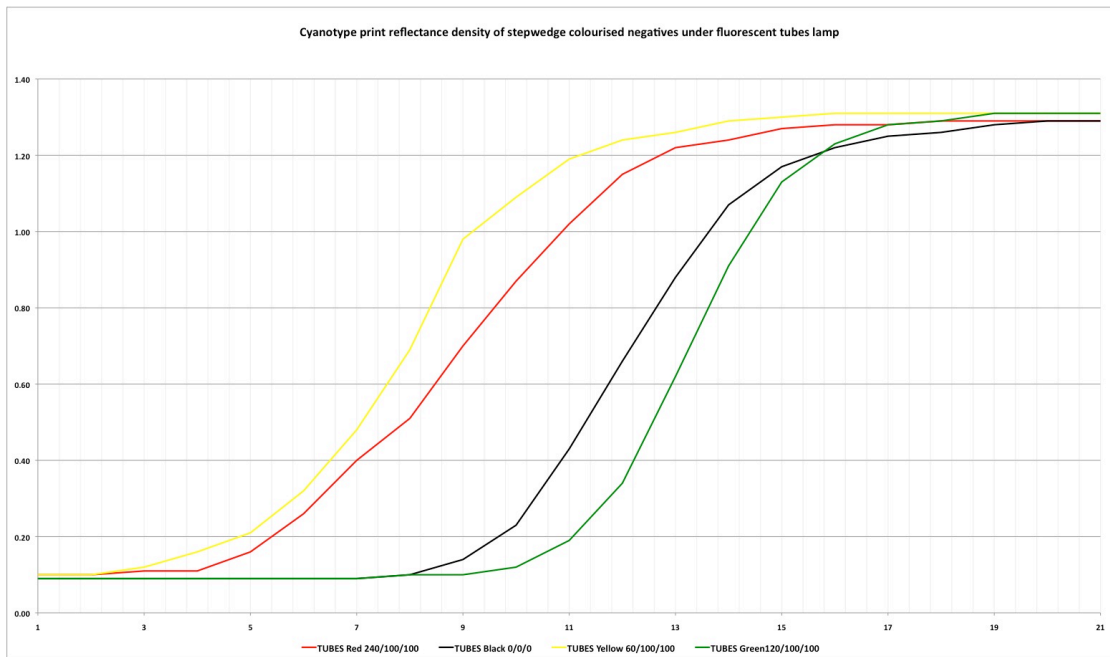


Figure A6.4.12 Cyanotype print densities of colourised stepwedges under fluorescent UV

colourisations, from the extended and varied toe and shoulder areas it may again be inferred that some negative colours facilitate greater tonal discrimination – yellow, perhaps, in the case of fluorescent tubes, black in the case of the LED light. Cyanotype and platinum printing processes, although both iron based, respond differently to density ranges of the negatives in order to produce the full range of print tones. Its clear that the platinum process accommodates a negative with a longer transmission density range than does cyanotype to achieve maximum print density, though only with most but not all colourisations. The data from the cyanotype and platinum exposures of the colourised stepwedges under the four UV sources can be interrogated to ascertain the negative UV transmission density range required to produce prints with a full tonal range from D_{min} (paper white) to D_{max} (maximum black for the process). The results are shown in *Table A6.4.13*, below.

Platinum					
	Philips	LED 395	Fluorescent	Metal Halide	<i>Average</i>
	Mercury		Tubes		
Green	2.55	2.39	2.4	2.24	2.4
Yellow		1.86	2.49	2.2	2.18
Red	1.95	1.95	2.19	1.65	1.94
Black	2.22		1.95	2.36	2.18
<i>Average</i>	2.24	2.07	2.26	2.11	
Cyanotype					
	Philips	LED 395	Tubes	Metal Halide	<i>Average</i>
Green	1.36	1.36	1.46	1.85	1.51
Yellow	1.21	1.06	1.85	1.34	1.37
Red	1.28	0.99	1.43	1.32	1.26
Black	1.58	1.31	1.29	1.31	1.37
<i>Average</i>	1.36	1.18	1.51	1.46	

Table A6.4.13

There are very interesting variations here. A green coloured negative under a LED UV light source requires a transmissions density of 2.39 (X-rite 361T densitometer) to secure full platinum print tonal range, whilst a red stepwedge under a metal halide exposure requires only a transmission density of 1.65 to produce the equivalent print tonal range. Similarly, cyanotype will print to full D_{max} on a yellow stepwedge under fluorescent tubes with a transmission density range of 1.85, whereas a LED 395nm source can produce that with a red negative of only 0.99 density range.

As discussed earlier, the reasons for these variations are not immediately apparent and require further investigations, but they can be exploited by considered choice of negative colourisation and UV lamp source: the greater the transmission density range of a coloured negative required to secure full D_{\min} to D_{\max} , the less severe the compensatory curve needs to be applied to effect linearisation and calibration, minimising the 'degradation' through posterisation of the image, and the finer and more controllable the tonal differentiations achieved on the print.

Appendix to Chapter Seven

A7.1 Phase 2 – questionnaires – ‘descriptive’ terms, by print process

Photogravure	Platinum	Cyanotype	Carbon Transfer	Inkjet-Gloss	Salt	Inkjet-Matt	Albumen
blacks deep	bleached	contrast good	blurry	blacks deep	clean, very	clarity, impresses	contrast, lack
contrast, lack of	bright	contrast not as forceful	chalky	contrast	depth	clarity,, exceptionally sharp	highlights, too bright
contrast high	chiascuro effective	contrast wonderful	contrast	contrast	depth not there	clean image	precise
contrast less	clean	detail	contrast, high	detail	depth, less	clear	sepia colour
contrasts, bring emotion	contrast effective	detail chiascuro very effective	contrast, not as clear	detail	detailed	colour, matt	surface, sheen
deep	contrast good	details very abstract	contrasty, too	detail good	flat	detail	tones, strange
depth to skin	contrast high	exposure good	definition, harder	detail sharp	flatter	flat	
detail good	contrast, more needed	flat	definition, high	gloss	grainy	grey-scale incredible	
detailing magnificent	detail best	flat	depth, great feeling,	gloss, doesn't worry	highlights too bright	hard edged	
details loss in shadows	detailed	good tones	detail, not enough	glossy	over exposed	paper, not feel good	

Appendix to Chapter Seven

A7.1 Phase 2 – questionnaires – ‘descriptive’ terms, by print process

Photogravure	Platinum	Cyanotype	Carbon Transfer	Inkjet-Gloss	Salt	Inkjet-Matt	Albumen
details some loss close up	detailed	image sunk into surface of paper becomes part image	dimensionality	glossy	over exposed	pose, forceful	
Detailing, least	detailed	light	flat	glossy, like a glossy print should	over exposed	pose, unusual	
flat, quite	detailing marvellous	light	furry	haptic, don't like	overexposed	reproduction great	
grain less grotesque	dimensional	light	hairy	oily	perspective, great depth	reproduction great	
grainy	flat	loss of fine detail	highlights, blown out	paper too clean	photocopy	shiny	
grainy	flat rather	natural feel of paper vs unnatural colour	ink less even	paper too cool	precise	silvery	
grainy	flat tones	not much depth	paper sticky	paper, clinically smooth	print, attractive finish	skin smooth	
grainy	flat too	over processed	reproduction, great	paper, doesn't fit subject	punch, lacks	skin tones good	
great	grainy	process suits image brilliantly	reproduction, natural	past and present	reproduction, not punchy	skin, surface very evident	
gritty	high quality	roughness of the paper liked	reproduction, quality good	photographically right	rough	smooth skin	

Appendix to Chapter Seven

A7.1 Phase 2 – questionnaires – ‘descriptive’ terms, by print process

Photogravure	Platinum	Cyanotype	Carbon Transfer	Inkjet-Gloss	Salt	Inkjet-Matt	Albumen
hazy	high quality	shiny	shiny	sharp	rough	straight print	
mid-tones beautiful	luminosity lovely	shiny	silk	sharp	sharp	surface, no interest	
paper too thin	matt	skin texture almost looks computerised effect	skin greasy	sharp	shiny	tone range good	
process suits image	mid-tones, its detail	texture	skin, brilliant	sharpened	soft	tone weak	
rough	over-bright	texture of paper	skin, wonderful contours	shininess, reduces impact	textured	tone, dull	
skin tones love	over-exposed	tones wonderful	tactile	shininess, emphasises structure	tonal range, wonderful	tones, love	
tactile	pallid	touch	texture	shiny	tone, single dominant	tones, very good	
technology aware of	precise very	velvety	tonal depth	shiny	tones, split distracting	touch, inviting to	
texture	present		tones, cooler	skin tones, not accurate			
texture to skin	real		tones, flatter	tangible			

Appendix to Chapter Seven

A7.1 Phase 2 – questionnaires – ‘descriptive’ terms, by print process

Photogravure	Platinum	Cyanotype	Carbon Transfer	Inkjet-Gloss	Salt	Inkjet-Matt	Albumen
texture, risible on skin	sharp		tones, recessive	textures clear			
tones darker	sharp						
touch	skin tones loved						
tree itself imposes	slightly blurry						
whites bright	surface, good sense of very						
	tactile						
	three dimensional						
	tone flattened						
	tones darker						
	tones lighter love depth						
	whites bright						

Appendix to Chapter Eight

Examples of prints for exhibition

The skin filters, mediates, and communicates what it means to be in/a body, cultivating self-reflexive encounters with one's own skin by looking at another's. When bodies are brought into relation through skin portraiture, feelings of empathy can be conveyed so as to intimately connect them in ways traditional portraiture cannot. Skin portraiture, therefore, disrupts boundaries between subject and object, so as to challenge not only the autonomy of the portrait, but also the autonomy of the body'. Kellett (2015: 239).

The 'practice-based' outcomes of the research were realised as prints using early photographic processing, and photographs of examples are reproduced below.

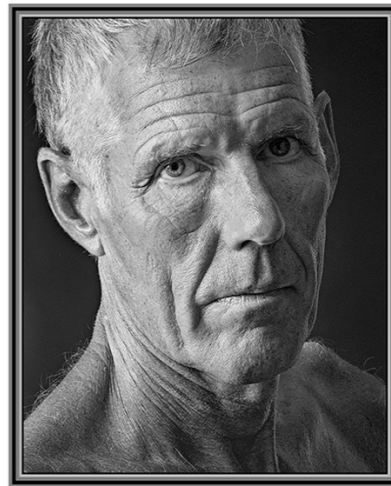
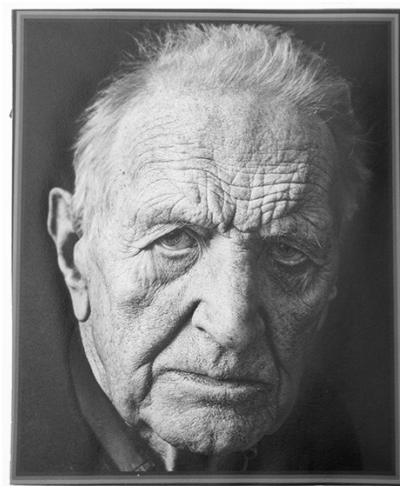
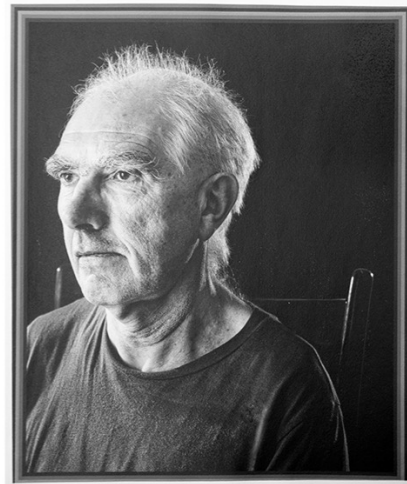
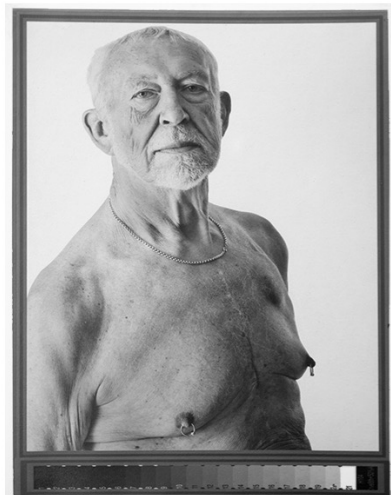


Illustration A8.1.1

Examples of carbon-transfer prints (Heads)

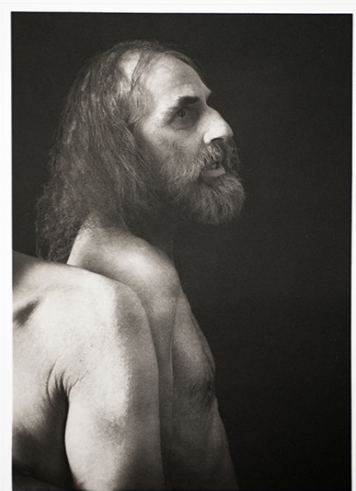
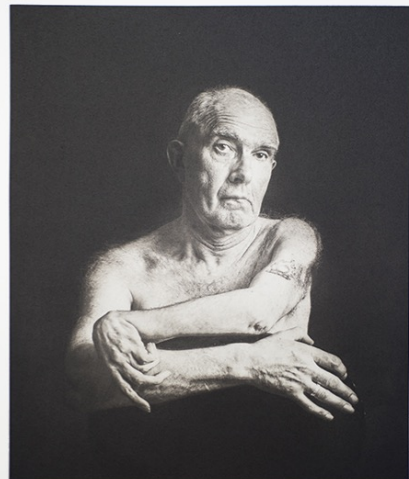
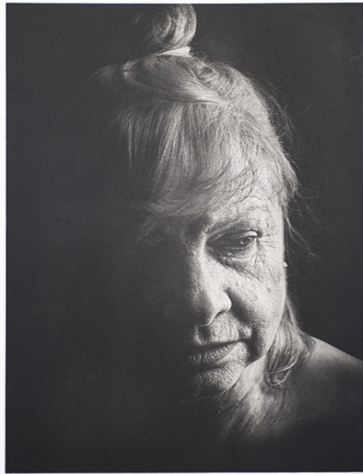
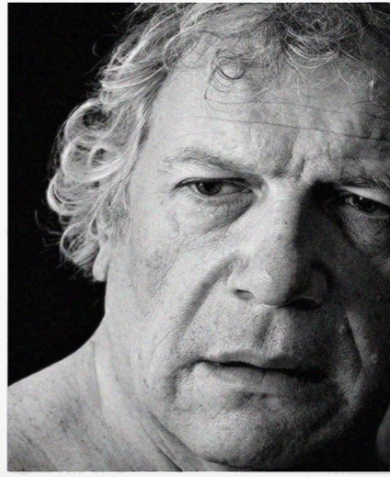
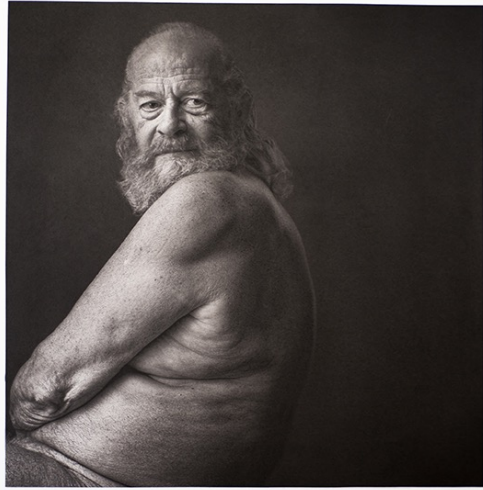


Illustration A8.1.2

Examples of photogravure prints (Heads)



Illustration A8.1.3

Examples of Platinum/palladium prints (Torso)

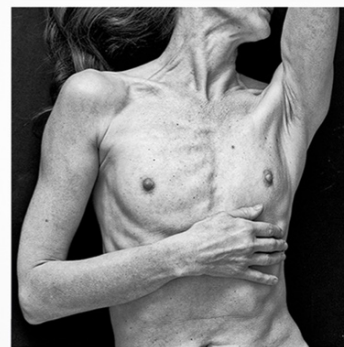


Illustration A8.1.4

Examples of Photogravure prints (Torso)

Illustration A8.1.5 Examples of Salt & Albumen prints (Couples)



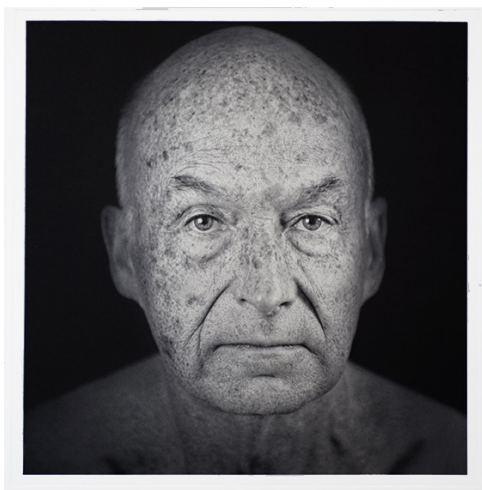
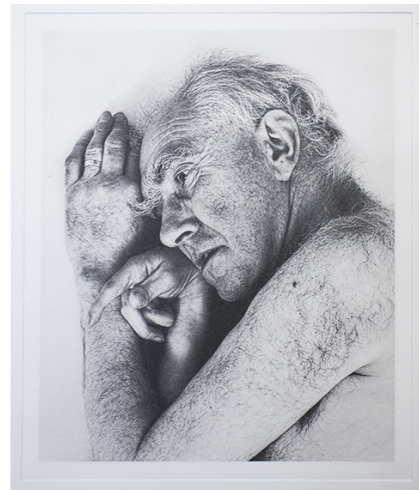
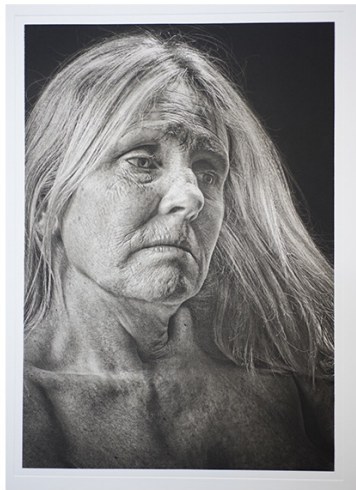


Illustration A8.1.6

Examples of Photogravure prints (Head & Figure)