Photography in the age of electronic imaging

INTRODUCTION

Since the first edition of this book was published in 1997, digital image technology has been ever more widely assimilated into photographic practice and many other areas of art, design and media. Recent critical thought reflects a much more complex interplay between photography and digital image technologies (or even 'post-photography') than was envisaged in most of the earlier attempts (between the late 1980s and the mid-1990s) to gauge and understand what the digital meant for the photographic. Nevertheless, there is a rich history of debate in this earlier work, and it gave rise to some challenging and still influential ideas, not least those of a new 'post-photographic' era, the 'end' of photography as we have known it, of an 'image revolution' of profound historical importance, and a crisis for photographic truth. In some ways, debates about these ideas continue. There will be readers for whom these are met for the first time, and others who are unaware of their history. Hence, this chapter, in this third edition of the book, retains some of the material which dealt with these ideas in previous editions. This is to be found in the sections entitled A 'post-photographic' era? and Technological change and cultural continuity. A number of the boxed sections which explain issues such as digital encoding, simulation, the manner in which the implications of digitisation for photography were initially conceived, and the 'analogue and digital' have also been retained. However, there is a new Introduction and a lengthy new section, Photodigital: taking stock. This updates the chapter by discussing the new, and more nuanced, directions in
which thinking about photography's relationship to the now older 'new' image technologies has taken. As always, however, the sense of more recent thinking depends to some degree upon knowing what it is taking issue with. This is a further reason for retaining some of the history of critical responses and efforts have been made to cross-reference new and old material, sometimes in the text itself and by use of the margin notes.

Two decades have passed since it became technologically possible to produce images which have the appearance of traditional chemical photographs by digital means. Two fundamental technological developments were involved. First, the digitisation of existing analogue photographs by scanners and the registering of images with a digital camera. In either case, an image that was made with an optical lens comes to exist as an electronic file instead of, or as well as, a material, analogue artefact. (See Box A: Digital encoding.) Second, the ability to produce photo-realistic images and simulate photographs using 3-D computer graphics systems. (See Box B: Digital simulation.)

The technology made possible:

(i) The transfer of traditional photographs from their basis in a material surface etched by light and chemicals to a set of numerical values, stored as a set of electronic impulses. The traditional photographic image was fixed – its digital version was mutable.
(ii) The registration of the information received through an optical lens directly as a set of numerical values.
(iii) The production of images that looked like photographs – generated from data and knowledge – where no human eye, looking through a viewfinder, had directed a lens at an actual object in the physical world, opened a shutter and traced its image.
(iv) The circulation of such images of all kinds, ancient, archived or contemporary photographs, as electronic data packages through telecommunications systems.

[For a more detailed list see Box C: Digitising photographs: the initial implications.]

Over the period, 'digital imaging' has developed into a major industry, and has become a taken for granted part of the media landscape. For many photographers, digital technologies and processes are now an essential part of their post-production practices, and have blurred the edges between older specialism, especially between photography, typographic and graphic design, editorial work, and still and moving image production. For others, digital technologies have all but replaced analogue technologies: optical lenses are replaced by digital and virtual cameras, films by discs, 'wet' physical darkrooms and optical enlargers by computers and software. At a consumer level, digital cameras, memory cards, scanners, writable CDs and associated software have largely replaced the mechanical camera and film on the shelves of high street photographic retailers. Even the snapshots once pasted into the
BOX A DIGITAL ENCODING

The encoding of the 'message without a code' (Barthes 1977b: 36) - the conversion of original analogue photographs to digital images.

Digital technology facilitates the introduction of a matrix of tiny manipulable elements at the physical base of the photographic image. This amounts to an 'infection' of the stable analogue photographic image by an intrinsically fluid and malleable digital code.

The material basis of the chemical photograph is the photographic emulsion, a granular structure of silver halides dissolved in gelatin and spread onto a plastic or acetate base. This emulsion holds the nearest thing there is to a photographic 'mark': the tiny light-sensitive grains of silver, the constituent bits out of which an image is configured. This material basis of the photograph has long been industrially produced. It is put in place by workers in the factories of Kodak, Ilford, Fuji or Agfa. The individual photographer has never had access to this level of signification, except to control the degrees of contrast which various intensities of light reflected from an object in the real world bring about within this granular field. It is in this sense, that something pre-exists the photographer's intervention in the forming of an image, that underpins our belief in the chemical photograph's special claim to veracity.

The computer with its immaterial field of binary switches has unlocked this inaccessible level of signification. Chemical grain can be scanned by a set of linked Charge Coupled Devices to become digital pixels. Digital pixels can also be made to mimic chemical grain. In short, a code has been imported into, has translated and reconfigured, the granular field of the chemical photograph. With this code in place the photographic image (now strictly speaking the 'photographic' image) becomes manipulable to a fine degree.

7.2 A three-stage illustration of the principle of digitising a photograph

The tones or colours of the chemical photograph which are represented by a seamless and random grain are divided into a grid of small picture elements (pixels). Each area of the grid is then assigned a number which corresponds to the brightness of a grey scale or to the three primary colours. Changes in resolution, definition and contrast can be achieved by changing the value of these pixels, and even the configuration of the image can be invisibly altered by removing or adding pixels.
The simulation of photographs: the production of images which have the appearance of a chemical photograph but which are constructed from information which is processed within the computer.

This use of computers represented a dramatic assault on the notion of photographic causality: the sense that photographs are caused by the objects and the lights that make those objects visible. This is the manner in which digital technology is being used to generate images, which have a photographic appearance, from pure data. The images which are constructed in this way have no traditional photographic referent. Such a 'photograph' may be based on knowledge of, but not caused by, the action of light reflected by a particular object. But what it does refer to is other photographs. In fact the whole motivation in the generation of many such images is that they carry the authority and information of a photographic image (and in the way that a photograph carries such information). Given this aim, the continuity of photographic codes between chemical and digital photographic production is strong.

Such 'object-based' systems work by using the computer to define the geometry of an object and then to render its surfaces by the application of algorithms which simulate the object's constructed surface according to information about viewpoint, location, illumination, reflection, etc. This ability of the computer to construct objects in space is in direct line with the perspectival geometry of the Western pictorial tradition. This has its roots in the work of fifteenth-century painter mathematicians and art theorists of the early Italian Renaissance, such as Leon Battista Alberti, Piero della Francesca and Paolo Uccello.

In this sense, the computer's simulation of photographic images shares much with the constructed perspectival views of early Renaissance painters. They both construct views of the physical world which are centred on the eye of a spectator in a given position, and they do so by organising information about objects, spaces, and the behaviour of light which is the result of observation, data and its rigorous conceptual systematisation.

An early account of the technology in question was William Mitchell’s detailed 1992 analysis, The Reconfigured Eye: Visual Truth in the Post-Photographic Era. His account of the emergence of digital imaging techniques begins with the 1950s construction of a mechanical drum scanner which traced the variations in tonal intensity on the surface of a photograph, converting them into binary digits which could be stored in the memory of an early form traditional family photo-album are now often stored electronically and displayed on the TV or PC screen. In film production, synthetic, computer-generated images are now seamlessly integrated with traditional cinematographic footage. However, images that have their source in a camera lens pointed at objects and events in the world and with a destination in the ink on a printed page are clearly as numerous and culturally important as ever. It is the processes that intervene between these two points that are digital, electronic and interactive, and frequently involve telecommunications networks for exchanging work in progress and as a means of distributing and exhibiting images.
BOX C DIGITISING PHOTOGRAPHS: THE INITIAL IMPLICATIONS

- A shift in the location of photographic production: from the chemical darkroom to the 'electronic darkroom' of the computer.
- The outputting of single photographic originals in an expanded range of ways, from 'hardcopy' through transparencies and varying forms of print, to the computer and TV screen, and websites.
- An unprecedented ease, sophistication and invisibility of enhancing and manipulating photographic images.
- The entry of photographic images into a global information and communications system as they become instantaneously transmissible in the form of electronic pulses passing along telephone lines and via satellite links.
- The high speed transmission of news images which are no longer containable within territorial and political boundaries.
- The conversion of existing photographs and historical archives into digital storage banks which can be accessed at the screens of remote computer terminals.
- The potential of the new information and image networks for greatly extending the practices of military and civil surveillance.
- The unprecedented convergence of the still photographic image with previously distinct media: digital audio, video, graphics, animation and other kinds of data in new forms of interactive multimedia.

7.3 (above) Diagrammatic representation of the concept of a 'virtual camera'

7.4 (left) Computer-generated image of billiard balls.
This image of impacting billiard balls is a computer simulation of 'photographic seeing'. These particular balls do not exist and neither does the room which is reflected on their surfaces. They are constructed mathematically and their surfaces are rendered according to the computer's 'knowledge' of the action of light upon specified kinds of surface, over a given distance and from a certain position and source, etc. The balls are represented in movement as if photographed with a shutter speed of 1/250 of a second. The realism to which this computer-generated image aspires is the 'look' of a photograph; realism equals the signifying means of the photographic image.
of computer (Mitchell 1992: 3). During the following three decades, largely driven by space exploration programmes, the need to transmit data over vast distances and to process it into pictorial form, led to sophisticated image processing systems (1992: 11–13). Mitchell points to the end of the 1980s as the moment when these technologies fed into the production of inexpensive 'point and shoot' digital cameras which then appeared on the consumer market. At the same time the personal computer began to have the processing power, memory, and storage capacity needed for image processing work. In the early 1990s interactive CDs became widely available and laser scanners for digitising images from existing photographs became popular and affordable computer peripherals. The result was that, 'the means to capture, process, display, and print photograph–like digital images – which had hitherto been available in only a few specialised scientific laboratories and print shops – now fell within reach of a wide community of artists, photographers, and designers' (1992: 18). Mitchell likens this moment to an earlier one (in the 1880s) when George Eastman introduced the Kodak 'Brownie' box camera (see chapter 3) laying the basis for a mass, popular practice of domestic photography: 'the burgeoning technology of digital imaging suddenly spawned a mass medium' (1992: 17).

A range of critical issues were soon raised by the emergence of 'digital imaging' and a new 'digital photography' and it was widely sensed that this was a moment of special significance in the history of media and visual representation. Its importance for visual culture was compared to the invention of photography itself (Mitchell 1992: 20) or the formulation of pictorial perspective in the fifteenth-century Renaissance (Crary 1993: 1). Depending upon the viewpoint of the practitioner or theorist it was a moment either to be celebrated as a release from the constraints of photographic representation (Ascott 1996: 165–73) or conversely, a moment of cultural panic in which the values and practices of photography were seen to be threatened (Ritchin 1990a, 1990b).

These stark terms in which the challenge of digital imaging technology for photography was initially posed often meant that sight was lost of the fact that there is no single thing called photography but – instead – there are many 'photographies' (Tagg 1988: 14–15). Two implications of the technological changes that we have traced above are that (i) the digital encoding or registering of a photograph means that it is open to alteration or manipulation to an unprecedented degree and (ii) that images of a photographic appearance, but which have no referent in the world, can be constructed by computers. These two possibilities seemed to strike at the heart of certain kinds of photography – documentary, photojournalism and related forms of 'straight' photography where photographic realism, photography's truth value, and its use as evidence and testimony, are particularly high (see also chapter 2). However, the new ability to manipulate and synthesise photo-
BOX D ANALOGUE AND DIGITAL

Traditionally, images were analogue in nature. That is, they consisted of physical marks and signs of some kind (whether brush marks, ink rubbed into scored lines, or the silver salts of the photographic print) carried by material surfaces. The marks and signs are virtually inseparable from these surfaces. They are also continuously related to some perceivable features of the object which they represent. The light, for instance, cast across a rough wooden table top, becomes an analogous set of tonal differences in the emulsion of the photograph. A digital medium, on the other hand, is not a transcription but a conversion of information. In short, information is lodged as numbers in electronic circuits. It is this feature of digitisation which has meant that images can now exist as electronic data and not as tangible, physical stuff. Some of the key differences can be set out as follows:

Analogue

transcription: the transfer of one set of physical properties into another, analogous, set
continuous: representation occurs through variations in a continuous field of tone, sound, etc.
material inscription: signs inseparable from the surface that carries them
medium specific: each analogue medium bounded by its materials and its specific techniques

Digital

cconversion: physical properties symbolised by an arbitrary numerical code
unitised: qualities divided into discrete, measurable and exactly reproducible elements
abstract signals: numbers or electronic pulses detachable from material source
generic: one binary code for all media, enabling convergence and conversion between them

Digitisation is also the effective precondition for the entry of photographic images into the flow of information which circulates within the contemporary global communications network. It is their translation into a numerical code that now enables them to be electronically transmitted. For the above reasons, questions have arisen about the place of images in time and space, where they can be said to actually exist, about how and where they are stored when in electronic form, how and by whom they can be accessed, used, owned and controlled.
A 'POST-PHOTOGRAPHIC' ERA?

With the coining of the term 'post-photographic era' in the early 1990s, a decisively historical and epochal dimension was given to the thinking about the impact of new image technologies upon photography (Wombell 1991: 150, Mitchell 1992).

Thinking of the wider significance of digital image technology for media and visual culture, the art historian Jonathan Crary spoke of 'the rapid development in little more than a decade of a vast array of computer graphics techniques' as bringing about 'a transformation in the nature of visuality probably more profound than the break that separates mediaeval imagery from Renaissance perspective' (Crary 1993: 1). While Crary himself asked questions about the completeness of this 'break', this was a bold claim and one which did not go unchallenged (Robins 1995).

However, by the early 1990s, there was a feeling abroad that the period of some 150 years in which photography had been central to visual culture was approaching its end. In many ways photography has been broadly understood as part of a longer tradition of visual representation in the West, variously as the industrialisation, the mechanisation and the democratisation of perspectival images and the privileged, centred, position these afford the human viewer. At the same time, photography (and film) have also been credited with enabling new ways of seeing the world and changing the very cultural status of images. Photography was also associated with truth, realism, and evidence. Finally, photography was closely connected to commodification; it had turned appearances of every kind into commodities, to be mass produced, bought and sold on an unprecedented scale and was an essential part of marketing the goods, services, and values of consumer culture.

The claims that a 'post-photographic' era was upon us did more than encourage a wave of speculation about what it might hold and how it would be different from the late nineteenth- and twentieth-century culture centred upon photography. They also led to a renewed interest in the emergence of earlier image and communication technologies and the claims that accompanied them (Marvin 1988; Boddy 1994). They continue to bring about a new kind of interest in the early histories of photography, film, radio and television as a way of researching the historical grounds for speculating about the direction of current changes in media, including photographic, technologies (Punt 1995; Slater 1995b, Huhtamo 1996).¹ In the sections that follow, each of these factors, raised by the concept of 'post photography' and

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¹ A recent example of this renewed interest in the history of photography understood as a technology in general and an image technology in particular is Patrick Maynard's book, The Engine Of Visualisation (1997).
which preoccupied theorists and critics of the photodigital in the first half of the nineties, will be discussed. The issues of cultural continuity are discussed in the section Technological change and cultural continuity.

In a parallel development, much interest arose in the history of the computer, especially the manner in which it came to be applied to image-making, as the machine which is credited with this epochal transformation (Darley 1990, 1991, Manovich 1996, Velman 1996, Mayer 1999).

**A new way of seeing and the end of the 'Cartesian dream'?**

Mitchell suggests that as new image technologies unsettled older, established attitudes and beliefs in the status of images, they looked set to take us beyond the historically specific (and therefore temporary) limits of photographic 'seeing' in a progressive movement which was in tune with a postmodern age. Had the application of the computer and digitisation to image-making brought an age of (false) innocence to an end? A false innocence belonging to the 150-year period during which chemical photographs provided us with images that we could comfortably regard as

causally generated truthful reports about things in the real world, and which could be confidently distinguished from more traditionally crafted images, which seemed notoriously ambiguous and uncertain human constructions.

(Mitchell 1992: 225)

The once fixed and stable images of photography 'served the purposes of an era dominated by science, exploration, and industrialisation'. This historical period was drawing to an end as we entered a 'post-photographic era' and had to face a new challenge to the fragile distinctions we were used to making between the imaginary and the real or, as Mitchell puts it, 'the tragic elusiveness of the Cartesian dream' (1992: 225).

The reference is to the seventeenth-century philosopher René Descartes and the 'Cartesian' tradition in Western philosophy which bears his name. This has generally come to stand for a search for certain and objective knowledge through the exercise of scientific reason; for a disinterested and rational method of enquiry untainted by the feelings and subjectivity of the observer. The attainment of such certain knowledge by an abstract reason exercised by a 'disembodied' mind is the 'Cartesian dream' to which Mitchell referred.

By the early nineteenth century such a search for scientific knowledge had taken a fiercely empirical turn and had been extended to the study of the social as well as the natural world within the social philosophical framework known as **positivism**. This was characterised by an exclusive concern
for empirically verifiable and measurable facts. A connection between this 'positivist' method and the birth of photography has been frequently noted. As John Berger put it,

The camera was invented in 1839. Auguste Comte was just finishing his *Cours* de Philosophie Positive. Positivism and the camera and sociology grew up together. What sustained them all as practices was the belief that quantifiable facts, recorded by scientists and experts, would one day offer man such total knowledge about nature and society that he would be able to order them both.

(Berger and Mohr 1982: 99)

As real as this historical link with positivist social science may have been, photography has never been exclusively contained within positivism's framework or limited to such uses.

It is, however, an aspect of photography's history which was thrown into sharp relief by the concept of post-photography and the apparently radical contrast between the mechanical process and optical realism of analogue photography and a new digital 'age of electrobricolage'.

The new constructed or 'virtual' visual 'spaces' of computer-generated imagery which were emerging, were radically different from the 'mimetic capacities of film, photography, and television' (Crary 1993: 2). Photography depended upon 'a point of view static, or mobile, located in real space' while the techniques of computer imaging were relocating, 'vision to a plane severed from a human observer' (ibid). As the new image technologies became 'the dominant models of visualisation', Crary suggested that:

Most of the historically important functions of the human eye are being supplanted by practices in which visual images no longer have any reference to the position of an observer in a 'real' optically perceived world.

(1993: 2)

Both Mitchell and Crary sketched out a scenario in which seeing and representing the world through a camera lens, from a definite position in space, were giving way to new forms of vision and image.

A vision in which older lens-based images are either converted into electronic data or new images are constructed directly from data which simulate the appearance of a photograph. These images can be infinitely changeable, as they continually circulate within global telecommunication networks, available for convergence with one another and other 'abstract visual and linguistic elements' (Crary 1993). Further, these images do not necessarily refer to anything that is empirically verifiable as 'real' but to ensembles of concepts, and to other images and data.
It is not difficult to see how, on this way of thinking, the traditional hand-me-down, Cartesian framework for thinking about how we observe the external world was deemed to have become hopelessly inadequate. Faced with Crary’s vision of the new image technologies, the question no longer seemed to be ‘can an observer see clearly from their position?’, but whether we, as observers, could continue to have any fixed or secure position from which to see anything that is material and stable! New possibilities for vision and visualisation were opening up, as the computer extended the realm of what the visual sense encompasses. On the one hand, we (or perhaps, given the globally and locally uneven distribution of technologies and information circuits, ‘some of us’, would be more accurate) were now able to ‘see’ distant planets, the inside of a beating heart, a molecule that is a concept, we could move through buildings which had not been built, we could window-shop in cyberspace. On the other hand, the qualities and formal means of images were undergoing certain kinds of change; this was probably most remarkable in terms of the spectacular extremes of scale and detail, of focus and viewpoint, of subtle and dramatic kinds of juxtaposition, in the degree of fragmentation and fusion, and in the transformation and mutation of images that we were coming to regularly see in the cinema, in advertisements on our television screens, and in websites and computer games. There was a scrambling, to an unprecedented degree, of the real and the imagined.

However, as Crary argued, we would not get far in understanding this newly ‘precarious’ position within a shifting scenario of images and imaging technologies if we failed to see it in a historical context (for there were precedents of sorts) and did not take account of the forms of social and cultural power which drive and shape such developments (Crary 1993: 2).
WALTER BENJAMIN AND THE PRECEDENT OF THE AGE OF MECHANICAL REPRODUCTION

Many art and photographic historians were quick to see how these developments echoed Walter Benjamin's classic account of the impact of photography upon the handmade image in his 1936 essay 'The Work of Art in the Age of Mechanical Reproduction'. Here, we take note of his influential ideas on photography, especially his concept of an 'age' of mechanical reproduction and why they immediately found echoes in the idea of a new 'post-photographic era'.

The parallel was so compelling that a good deal of the earlier writing which dealt with the significance of digital imaging for visual culture explicitly played with Benjamin's original tide (including the tide of this chapter itself). Articles and scholarly papers with tides which echoed Benjamin's abounded; transposing the 'Mechanical Age' to the electronic, the cybernetic, the digital, the post-photographic age, era, or culture. The newspaper pastiche 'Mute', which reports on new media and related techno-cultural issues, once sported the banner, 'The Work of Art in the Age of Post-Mechanical Reconstruction!' (Nichok 1988; Virilio et al. 1988; Grundberg 1990b; Malina 1990; Jukes 1992).

Why? Benjamin, writing over 60 years ago, offered two basic sets of propositions about the epochal significance of film and photography as means of mechanically reproducing images.

The first concerned the power of a new image technology, photography, to reproduce autographic images. A second set concerned the particular ways that the camera — still and moving — represented the contemporary world itself. These two sets of propositions were rapidly transposed in efforts to think: about the impact of digital technology upon photography.

Benjamin pointed out that mechanical reproduction substituted a 'plurality of copies for a unique existence' (Benjamin 1939: 223). These were not copies in the sense of fakes (they could not be passed off for the original) or imperfect handmade copies, but were the outcome of an independent technical process. Through this process, images which had previously existed in one place at one time could now be seen simultaneously by a variety of new audiences in a diverse range of situations. Knowledge of the work was no longer restricted to being in the presence of the original. The images were no longer dependent upon their original contexts for their meaning and became open to multiple interpretations and readings. They could also be put to new uses. For instance, it became possible to compare and connect images that were previously separated in space and time. Reproduction created a new kind of portable cultural object (Lury 1992: 396) which was free from the controlled environments and rituals of the church, the civic state, and the aristocratic cultures in which the unique handpainted image had been predominantly produced and used.
Now, it was the photographic image itself which was subject to a similar process as it was converted, reproduced or simulated in digital form, stored electronically, and transmitted by telecommunications networks. Hence, the question arose as to whether a second 'electronic' or 'digital' revolution in visual culture was taking place which would usurp the role that photography had in the 'age of mechanical reproduction' and which Benjamin first described.

Benjamin's second set of propositions concerned the camera itself. He recognised that photography developed as a part of the scientific and technological endeavours of nineteenth- and early twentieth-century industrial capitalism. The physical context of this development was the nineteenth-century city. He stressed the way that urban experience was newly characterised by speed, rapid change and a fragmentation of everyday experience. This was brought about by new transport and communications systems, by the industrial division of labour on the production line, and by the separation of leisure and work in a wage labour economy. Benjamin argued that a rapid succession and juxtaposition of shifting viewpoints and experiences confronted the city dweller in their everyday lives. The new industrial and urban environment bombarded him or her with an unprecedented level of physical and psychological shocks (Benjamin 1939).

Benjamin sees the camera and its images as making this bewildering environment possible to contemplate. He points to the way that still photography renders faithfully the plethora of everyday detail that would normally be overlooked. He points to factors such as the way in which the photographic camera can put the 'eye' in places that it could not otherwise be, or the way in which the shutter freezes action not perceivable by the eye alone. With movie film the speed of human and mechanised action was slowed down. Through editing, a range of shots, frames and actions, matching the bewildering viewpoints of the city dweller, could be put together in a coherent narrative. Benjamin suggests that, in this period, a kind of 'optical unconscious' was revealed by the camera, just as, through psychoanalysis, 'the instinctual unconscious' was discovered.

So, in Benjamin's view, photography, and then cinematography, were particularly suited to depict the changed environment of industrial societies and, moreover, they could reach mass urban audiences rather than small elites. They represented a new way of organising perceptions within the dramatically changed environments of early twentieth-century cities. In his 1988 essay, 'Postmodernism and Consumer Society', Fredric Jameson had proposed that our perceptual skills and habits were again lagging behind our apprehension of a new kind of urban environment, represented most clearly in the new forms and spaces of postmodern hotels and shopping centres.

My implication is that we ourselves, the human subjects who happen into this new space, have not kept pace with that evolution . . .
[of postmodern architectural space] ... we do not yet possess the perceptual equipment to match this new hyperspace ... in part because our perceptual habits were formed in that older kind of space I have called the space of high modernism.

(Jameson 1993: 198)

Jameson makes it clear that he sees himself as following in Benjamin's footsteps when making this point (Jameson 1993: 202). Similarly, albeit in the sphere of visual representation rather than architectural space, it was argued that we were moving rapidly into a time where the new means of digital and electronic imaging were coming to supersedes those of the age of mechanical reproduction. As they did, it was suggested that new kinds of perception were being born, which were adjusting to a world in which significant global economic, technological and cultural change was taking place on a scale that was likened to that of late nineteenth- and early twentieth-century industrialisation itself.

Although interested in film rather than still photography, Bill Nichols investigated the idea of such a parallel in his 1988 essay, 'The Work of Culture in the Age of Cybernetic Systems' (1988: 27). Here, following Jameson (1984), he drew up three parallel lists of the technological, legal and cultural features of three stages of capitalism - the entrepreneurial, monopoly and multinational. With more emphasis on social and economic processes, David Harvey (1989: 174–9) has also reproduced a number of charts which represent the changes that have been seen to take place in the transition from industrial capitalism to present conditions, variously described as 'late capitalist', 'disorganised capitalist', 'postmodern', 'post-industrial' and 'post-Fordist'. In a much reduced form the kinds of change which are pointed to in this way of thinking are as follows:

<table>
<thead>
<tr>
<th>the mechanical camera</th>
<th>the electronic computer</th>
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<tr>
<td>the photograph</td>
<td>the digital image</td>
</tr>
<tr>
<td>industrialism</td>
<td>a 'post industrial age'</td>
</tr>
<tr>
<td>the modern era</td>
<td>postmodernity</td>
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<tr>
<td>modernism</td>
<td>'postmodernism'</td>
</tr>
<tr>
<td>rationalism/positivism</td>
<td>structuralism/post-structuralism</td>
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The end of photography as we know it?
A fear for the demise of photographic truth was one of the initial responses to digital image technology. Traditional claims about photography's truth value have rested upon the causal relationship between the photographic image and the real world. In realist theories, photography was primarily defined by its technical basis: the way in which light reflected by an object or event in the real world is registered on the film emulsion (or, in the case of video,
on electromagnetic tape). The photograph was understood as an index or trace of what had caused it. But it has long been clear that this aspect of the photo–mechanical process has only a small part to play in the meanings that a photograph has. (For discussions of realist theories of photography and their fallacies see Snyder and Alien 1975; Snyder 1980.) Subsequently, the ambiguously complex meanings of photographs have been understood to be the result of complex technological, cultural, ideological and psychological processes in which indexicality is but one element.

Despite this recognition, in the early thinking about digital technology's impact upon photography this indexical quality was frequently stressed above all others, especially in the polarised debates of the kind which saw photography as 'old, bad and limited' versus the digital as 'new, good and open-ended'.

Such positions and debates short–circuited much of what has long been understood about photographic representation. They diverted attention from the whole range of decisions, conventions, codes, operations and contexts which constitute photographic meaning. However, even where such ill-informed oppositions were avoided, there was still a sense in which many practitioners felt that the ethics and politics of photographic representation were under threat. This was the position taken by Fred Ritchin, a photographer and teacher of photojournalism, who claimed that 'the new malleability of the image may eventually lead to a profound undermining of photography's status as an inherently truthful pictorial form' (Ritchin 1990b: 28; my emphasis). This, however, is not the only way in which the issues were conceived. Martha Rosler, an artist and critical theorist, argued that they could not be posed in terms of photography's essential or inherent truth value. Her thinking on the matter proceeded by stressing that 'Any familiarity with photographic history shows that manipulation is integral to photography' (1991: 53; my emphasis).

In the face of what she saw as 'slightly hysterical' pronouncements that 'photography as evidence of anything is dead', Rosler wanted to remember a more complex history of photography in which contradictions abound and its objective realism is not an essential quality of the medium. Instead, as we shall see, she argued that photographic truth is based upon a set of historically and culturally specific beliefs about photographs as documents. (See also Kember 1998 and the discussion in the sections Remembering photography's nature and Our belief in photography's realism.)

More recently, Batchen (2001: 138–9, and see also Manovich 2003: 245) has made the point even more strongly when he states that, 'the history of all photography is a history of image manipulation'. We hardly need to look to the usual and more obvious examples of combination printing, photomontage and the like, to see the force of this point. So-called 'straight photography' is no exception even though it is the basis of several industries

In more recent thinking about the photodigital the issue of indexicality has been seen as far more complex, more carefully distinguished from questions of photographic truth, and recognised as a factor in our reception of digital as well as traditional photographic images. (See: Photodigital: taking stock, where this is discussed.)


which rely upon an exclusive stress on the mechanical nature of photography and the lack of subjective intervention this is thought to guarantee (journalism, surveillance, medicine, science).

'Straight photography' is frequently assumed to be some kind of photographic norm from which other, more overtly manipulative, photographic processes deviate. However, 'Digital technology does not subvert "normal" photography because "normal" photography never existed' (Manovich 2003: 245). The very process of producing a single photographic image – the passage from the brief opening of the camera's shutter trained on an object or event in the physical world to a completed and exhibited or reproduced print – is already a complex process within which a great deal of mediation takes place. When seen as a whole, each moment in this process (camera position, camera angle, focal length of lens, control of light, use of filters, length of exposure, nature of film emulsion, the method of development, the craft of printing) is a moment of choice between options, an intervention in how the photographic image will relate to a notional direct and unmediated recording of the photographed object.

As one of the 'classic' American 'straight' photographers, Edward Weston, observed some 40 years ago when digital imaging was hardly on the horizon,

within the limits of his medium, without resorting to any method of control that is not photographic (i.e., of an optical or chemical nature), the photographer can depart from literal recording to whatever extent he chooses.

(Edward Weston, (1964) 'Seeing Photographically', The Encyclopaedia of Photography, Vol. 18)

We will first attend to Ritchin's thoughts on the issue which express some widespread concerns relating to the professions of documentary and photo-journalistic practice in particular. (See also chapter 2.)

For Ritchin (1990a), the choices the photographer makes at the point of exposure (which could now be digitally altered in retrospect), together with subsequent editorial and post-production manipulations, were so greatly extended by the use of computers that ethical problems arose 'with the greatest urgency' (1990a: 29). He argued that traditional manipulations of photographs were somehow held in ethical check and were usually undertaken without 'damaging the image's integrity'. New digital image technologies meant that an 'editor has the ability to reach into the guts of a photograph and manipulate any aspect of it', much in the way that texts can be edited and the writer's meanings subtly but effectively altered.

Ritchin, whose thinking is haunted by an Orwellian nightmare of a future digital dystopia (1990a: 3), searched for strategies which would enable photo-journalists to ward off the digital undermining of their vocation. However, he was too keenly aware of the semiotic complexities and the politics of
photojournalism to be able to seek reassurance in any simple idea of photographic realism. He recognised that the genre of documentary photography has long been the subject of critical debate, and that naive reflection theories have for some time ceased to inform most documentary photographic education and practice (1990b: 28). And, given this history of critical debate, Ritchin then sees 'the application of computer technology to photography' as a second challenge to what he calls 'photography's putative capacity for reliable transcription'.

Ritchin entertained two responses to this second challenge. First, he plays with the idea of securing a protected category of stable, verifiable images, whose trustworthy status would, in some way, be officially accredited. One can imagine some kind of 'kite mark' or official caption stating that this is a 'certificated' chemical photograph or an 'ethically manipulated' digital photograph (1990b: 28–37). With this suggestion Ritchin came close to occupying a defensive, rearguard position that William Mitchell foresees for photojournalists:

Protagonists of the institutions of journalism, with their interest in being trusted, of the legal system, with their need for provably reliable evidence, and of science, with their foundational faith in the recording instrument, may well fight hard to maintain the hegemony of the standard photographic image.

(Mitchell 1993: 7)

Second, Ritchin (1990b) avoided basing his defence of photojournalism on any form of technological veracity and shifted it to the ground of authorship. In fact, Ritchin's best argument was based upon his view that there should be some parity between the photojournalist and the journalist who writes, where the authority of the writer's report is based upon the reputation of the author and the institutions for which they work. Finally then, Ritchin seemed to accept that the value of the photographic image in a digital age would not be secured by tracing its truthfulness to its origins in a photo-chemical process. Rather, it must rest on the conscience and reputation of the photographer who made the image. In this one respect, he came close, as we shall see, to sharing Martha Rosler's argument.

Overall, Ritchin cast the difficulty for photojournalism in a digital age as a largely personal and ethical problem — a problem for individual photographers and picture editors as they were pitched into a situation where truth and integrity became ever harder to defend against what he saw as an inherently unscrupulous and deceitful digital technology.

Digitisation and the commodification of images
We have seen how Fred Ritchin argued that a kind of photographic integrity was at stake as digital image technology dramatically increased the possibilities
of image manipulation. Yet, at the same moment, Martha Rosler reminded us of the part that photography itself has played in creating a market in illusions throughout the twentieth century, she offered a view of the fragility and partialness of the 'modern' idea of photographic truth. In doing so, she pointed to a history in which photography brought about a condition where we 'prefer the sign to the thing signified, the copy to the original, fancy to reality, the appearance to the essence' (Rosler 1991: 61).

In this essay, 'Image Simulations, Computer Manipulations: Some Considerations', Rosler has no time for the opposition between photographic truth and digital manipulation which was becoming central to much discussion about 'post-photography'. She warned that 'critical considerations of the possibilities of photographic manipulation tend to end with the tolling of the death knell of truth. This discussion will not end that way' (Rosler 1991: 53). The manipulation which Rosler saw as integral to photography itself is shown by any familiarity with photographic history from the very earliest uses of multiple negatives by photographers like Oscar Rejlander.

In Rosler's thinking, any sense of there being a crisis of photography's truth value is to fundamentally mistake what is going on. She agreed that we may no longer look at photographs as ways of communicating facticity, but that doesn't amount to asserting that "truth is dead" or that "photography is used up" (Rosler 1991: 53). For we are mistaken if we think that the changes which are taking place are simply or primarily caused by the new technologies, or that some kind of essential 'nature of photography' was undergoing change. She argued that we needed to look at wider cultural factors and recognise that our ideas and beliefs about photographs, as well as many other things, were changing.

Rosler stressed the importance of understanding that the straight photography of documentary and journalism is a genre. It has its own history, a politics, and institutional frameworks (of the press and broadcasting) which lend it its special, if contestable, authority. The term 'straight photography' points us to a way of making photographs in which evident artefact, construction and manipulation are avoided as a matter of principle. It does not, and cannot, mean an unmediated, uncrafted photograph or an image which is not the result of intention and shaping by the photographer. The very choice to work in this way, to avoid dramatic and rhetorical artificial lighting, for example, to resist any setting up and orchestration of the subject, or the many manipulations and devices of the darkroom, is itself the outcome of working with ideas and making choices within a wider set of possibilities.

The question was not how accurately or objectively photographs represent the appearance of reality but whether they, or any other kinds of image, can be used to 'tell the truth' about a reality whose appearance can itself be an illusion. In seeing the issue this way, Rosler points to the openly manipulative, alternative traditions of photography, represented by the photomontages of the Dadaists and John Heartfield. Theirs was a way of using
photography that sought to prise open and dismantle appearances in order to point to the social realities that their surfaces do not reveal. In her essay, Rosler sees these political photomontages as sharing with the early practitioners of photography, those who used multiple negatives to overcome the limitations of orthochromatic film, a search for a 'truer truth, one closer to conceptual adequacy' (Rosler 1991:54). If, then, manipulation is recognised as integral to photography, it is best embraced and consciously directed.

If we want to call up more hopeful or positive uses of manipulated images, we must choose images in which manipulation is itself apparent, not just as a form of artistic reflexivity but to make a larger point about the truth value of photographs and the illusionistic elements in the surface of (and even definition of) reality. . . .

Here we must make the requisite bow to Brecht's remark about the photo of the exterior of the Krupp works not attesting to the conditions of slavery within.

(Rosler 1991: 58)

Rosler argued that the 'identification of photographs with objectivity is a modern idea' and it is one that may be passing together with many other certainties of the modern age, such as a belief in progress. The meanings that images carry, whether photographic or digital, are not 'fully determined by the technologies used in their production', but they are shaped by the ideas and beliefs that are invested in and brought to them. Further, 'the questioning of photographic truth' is part of a 'more general cultural delegitimisation [that] is at work in industrial societies' (Rosler 1991: 63). Rosler has in mind Guy Debord's theory of a 'society of the spectacle' in which the cultural industries of capitalist societies, which centrally included photography, have turned the very look of the world, its appearance, into a type of marketable commodity (Debord 1970). This was the material basis for a far-reaching change in the status of images, and it is one that substantially took place across the late nineteenth and the first half of the twentieth century, prior to the emergence of digital image technologies.

Images, then, had already been severed from any simple equation with 'truth' in the earlier history of the mass production of images, advertising, cinema, propaganda, popular visual culture and spectacular entertainment. The question of the truth value of images or the reliability of the evidence which they provide does not simply rest on the kind of technology which was used to produce them, whether mechanical, electronic or digital. The use of photographs for propaganda purposes, argued Rosler, 'neither began nor will end with the electronic manipulation of photographic imagery'. Rosler's approach, (first published in the late 1980s), strongly anticipates elements in the work of Kember (2003) and Manovich (2003) which are discussed in the section: Photodigital: taking stock.
Post-photography, postmodernity and language

The idea that digital images are essentially more provisional, mutable, hybrid and 'in process' than the fixed images of photography together with the way in which digital image software could be used to dismantle, alter, and construct photographs, led to a number of analogies being drawn between digital imaging, post-photography, and poststructuralist theories of language.

A software application, such as Adobe Photoshop, is a heuristic tool for understanding and rehearsing photographic codes and qualities. Within a few hours' use, such a program allows the user to explore many of the manipulations and conventions which are part of the practice of photography. In this way, digital imaging software can be a means of understanding photographic representation and the nature of photographic 'language'. Digital technology became a critical tool which could demonstrate in practice what had been argued in theory for some three decades: that photographic images are themselves special kinds of constructions. This 'deconstructive' project was itself fully in line with aspects of postmodern cultural practice which emerged strongly in the 1980s and were associated with a self-conscious and playful use of language and style – whether visual, literary or architectural – and set out to reveal their manner of operation.

Further, an analogy can be drawn between the open-endedness of the digitised image and poststructuralist theories of language and meaning drawn from the philosopher Jacques Derrida's ideas about the nature of language and meaning. The emphasis in such theories is upon the polysemic nature of signs (their capacity to mean more than one fixed thing) and their indeterminacy (the way that language and sign systems are always 'in process' because they are being continually modified and nuanced as they are written and spoken in differing social contexts). They never reach a final destination of fixed, settled meaning; that is, any kind of 'closure'. In the realm of visual images, digital technology was then seen as deconstructing the singular, fixed images of photography (their objectivity and closure) and in this process, we were being released from the grips of a worn-out and ailing photographic tradition and its outmoded mission. It is Mitchell, again, who introduces this idea when he sees digital technology as being able to,

expose the aporias in photography's construction of the visual world, to deconstruct the very ideas of photographic objectivity and closure, and to resist what has become an increasingly sclerotic tradition.

(Mitchell 1992: 8)

More recently, in a complete reversal of this argument, similar 'Derridean' ideas have been used by Geoffrey Batchen to suggest that photography
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is itself a digital process. Photographs are a special kind of sign; they are indexical signs, signs which are caused by the objects they represent (see p. 331 'The force of the indexical image') but they are nevertheless signs (Batchen 1997: 215). Poststructuralist theories of language insist that it is in the nature of linguistic signs that they are unstable. Any particular sign has the meaning(s) it does because it has a relation of difference to other signs; another way of saying this is that its meaning derives from what it is not; any sign entails others, and is always referring beyond itself to others which are not present.

Whenever a sign brings something to mind or calls up its presence, it therefore relies on something that is absent. If we think of photographs in such poststructuralist semiotic terms we may override our preoccupation with the photograph's special indexical status and we are returned once more to see how a photograph's meaning arises from an unstable, relational play of signs. Batchen concludes that this is tantamount to recognising that photography itself is a digital process; it signifies through a system of signs playing across a field of presences and absences, positives and negatives, '1's and '1's.²

TECHNOLOGICAL CHANGE AND CULTURAL CONTINUITY

If much of the initial thought about the place of photography in an age of electronic imaging was based upon ideas of historical ruptures, breaks and radical change, not only in the means of producing images, but also in culture at large, these ideas did not go unchallenged. Media theorists and historians argued that such a view failed to take enough account of photography's history in particular, and the kind of relationship that new technologies have to cultural change in general. They argued that such claims place too much emphasis on the evident technological difference between photographic and digital processes. A preoccupation and fascination with technological difference obscured important elements of continuity in the cultural meaning and uses of technologies. (See also Photodigital: taking stock, p. 327 for some further outcomes of this tendency.)

Rather than simply see a break between the 'old' chemical technology and the 'new' electronic and digital one, these critics argue that we also have to see how both are shaped and developed by powerful social and cultural forces which run through nineteenth- and twentieth-century Western culture. The difference between analogue and digital image technologies is only one factor within a much larger context of continuities and transformations. In short, in order to assess the significance of new image technologies we also have to look at how images are used, by whom, and for what purposes.

This reversal, the use of a similar set of propositions about the nature of language, first (in the early 1990s) to argue for the novelty and difference of post-photography from traditional photography (Mitchell 1992) and then some seven years later (Batchen 1997) to argue for a fundamental identity between the digital and the photographic, chimes well with the changing times. For as we suggest in the last section of this chapter, much recent thinking about the photodigital attends far more to their interplay than to their simple difference.

2 For his account of this argument and also his ideas about the different relation that photographic and digital images have to tune, see GEOFFREY BATCHEN (1997) Burning with Desire, Cambridge, MA: The MIT Press, pp. 207–16.


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For instance, a major use of new image technologies is to be found within medicine, where they are being used to make the interior of the living body visible. Some writers have stressed the way in which such new, non-invasive, medical imaging techniques can be seen as liberatory and wholly benign (Stafford 1991). However, in her study of the way in which these technologies are being used to produce and construct images of the body within medical science, Sarah Kember argues that the highly mediated images of CAT scans and Magnetic Resonance Imaging have their antecedents in nineteenth-century medical photography. For Kember, 'there is in fact no clear separation between photo-mechanical and electronic imaging in the context of the surveillance and classification of the body' (Kember 1995a: 95–6). Both, she argues, participate in the gendered power relations of an increasingly technologised, masculine medical science which seeks to dominate the female body with its connotations of the 'natural' and 'maternal'.

In order to see the kinds of cultural continuity which run through technological change, we have to pay attention to the institutions and social sites in which new image technologies are being applied, and to the established cultural forms and practices which are being extended and transformed through such use. These sites are predominantly ones in which the photographic image has long been put to work: in the production of news, in the making of art, in advertising, in military and civil surveillance, in the production of spectacle and entertainment, education and pornography, to name only the more obvious ones.

Before looking more closely at two examples of such sites and uses, we will note a number of more general ways in which the use of digital technology can be seen as an acceleration or intensification of photographic processes that have a lengthy history. To see, in fact, that digital technologies are used to continue and build upon photographic forms.

**Photography's promiscuity: its historical interface with other technologies, sign systems and images**

Throughout its history, photography has always enjoyed a complex relationship with other text-based or visual information media.

(Bode and Wombell 1991: 4–5)

The new digital media, in their interactive, multimedia forms, were immediately celebrated for their capacity to generate polysemic meanings which involve the viewer's active participation. The two main bases for this were the capacity of digitisation to bring about, first, a convergence of previously separate media and, second, an 'interactive' relationship between the viewer and the text.
The first wave of critical responses to digital image technology overwhelmingly valued this capacity to produce layered and open-ended images which are always in creative process. By being included within digital multimedia formats, photographic images were newly exposed to multiple contexts of sound, other images, speech and text, etc. Multiple, alternative, radical and unexpected meanings were then seen to be the result of this new kind of complex of messages. Moreover, such meanings could now be discovered or created by the viewer (or 'user') as they interact with material which is structured with their participation in mind.

In this celebration of 'new' media, an opposition was often made, or implied, with an idea of an older 'pure' photography which was an 'automatic' source of fixed, singular and stable meaning (Robins 1991: 56–60; Lister 1995b: 8–11). The evident technological difference between photographic, camera-based processes on the one hand, and digital, computer-based processes on the other, also became the basis for constructing different intellectual and creative conceptions of practice, production and, in particular, of what is involved in viewing or using images. There are, indeed, differences to be thought about, as there were between the traditional practices of working with still or moving images, or between making 'silent' and 'talking' movies. However, it is an altogether different matter to jump to the conclusion that the convergence of older media brought about a completely novel and unprecedented situation. There was also a danger here that 'convergence' was assumed to be an inevitable achievement of the technology, rather than a matter of how it is used, what it is used for, and whether, in any particular case, it is of value to use it.

The degree to which these factors of convergence and interactivity tended to be seen as entirely new features of 'digital' art, media and communications was dependent upon failing to take into account a number of factors. When such factors are included in our thinking, the frequently made opposition between the photographic and the digital turns instead into a picture of the latter extending and building upon some key aspects of the former. This is important to remember; otherwise, two difficulties arise.

First, the degree to which digital image production draws upon the received conventions and codes of older media is lost to sight. 'Codes' are not just a matter of routine practice or 'know-how', but have ideological weight. This means that there is a danger that a rich resource can, in fact, be drawn upon, but without an informed, critical awareness of the politics of representation which have been developed around these practices. Second, the euphoric over-evaluation of digital 'culture' which was achieved by means of simple and ahistorical oppositions, placed photographic culture in a poor light and obscured its continuing power and complexity (Robins 1991: 56–7).
Three features of photographic culture will indicate how the meanings and uses of photographs, in a pre-digital period, have involved issues of convergence and relationships with other media. (For a discussion of the limits of the current opposition between ideas of the 'passive' viewer of photographs and the 'interactive' user of digital multimedia, see Lister 1995b.)

- Mass-produced, mediated and hybrid 'photographic images' have circulated throughout the twentieth century. This has depended upon a convergence of photography with print, graphic, electronic and telegraphic technologies. As John Tagg put it, 'the era of throwaway images' began in the 1880s with the introduction of the half-tone plate. It was this interface of the chemical photograph with print technology which 'enabled the economical and limitless reproduction of photographs in books, magazines and advertisements, and especially newspapers' (Tagg 1988: 56). In 1903 the telegraphic transmission of half-tone images became possible and the Daily Mirror launched a photo-telegraphy service as early as 1907 (Harvie et al. 1970).

- Photographic images have seldom been met in isolation. They are embedded and contextualised in other signifying systems, primarily, those of the written or spoken word, graphic design and the institutional connotations of power, authority, neutrality or glamour. As Barthes (1977a: 15) puts it, the photograph is at the centre of 'a complex of concurrent messages'. In a newspaper these are the text, the title, the caption, the layout, and even the title of the newspaper or publication itself: a photograph can change its meaning as it passes from the page of the conservative to the radical press. Photography as an element in a complex of 'concurrent messages' pre-dates the technological convergence of the new hybrid media.

- The sheer number of photographs circulating in the world, and the frequency with which we meet them, is also a basis of their intertextuality. None is free-standing. Each one is a small element in a history of image production and a contemporary 'image world'. Within this environment, the photographic image gains its meaning by a continual borrowing and cross-referencing of meanings between images. The still photograph quotes a movie, the cinematographer adopts the style of an advertising photographer, the music video mimics an early silent movie.

We can now consider this argument for continuities of use and cultural meaning between pre- and post-digital photography by looking at two brief case studies. They are chosen from many possible ones. Whilst not discussed here, equally strong examples can be found in the production of erotica and pornography (Graham 1995), and the relationship of digital image culture to domestic snapshots (Slater 1995b).
CASE STUDY: WAR AND SURVEILLANCE

From the original watchtower through the anchored balloon to the reconnaissance aircraft and remote sensing-satellites, one and the same function has been indefinitely repeated, the eye’s function being the function of a weapon.

(Virilio 1989: 3)

The remote digital video cameras, sensors and image processors used in modern warfare have taken over and extended an historic role of photography. Paul Virilio clearly has in mind that an early use of photography was the mounting of a camera in a balloon for the purpose of aerial reconnaissance. In this way vision and its record were placed in the service of military intelligence; it was given a new vantage point and power. This has been built upon ever since, as a sequence of new image technologies has been harnessed to, and often developed for, military surveillance purposes. With the contemporary use of satellites, remote sensing technology, digital enhancement of images, and the establishment of global information networks, this early means of lifting a mechanical eye above the enemy has continued to develop. A point has been reached where the entire planet is ‘becoming encapsulated by whole networks of orbital devices whose eyes, ears, and silicon brains gather information in endless streams’ which produce a kind of ‘portrait of what is happening on planet earth painted electronically in real time’ (Robins 1991: 72).

In the nineteenth century, portable, if cumbersome, darkrooms were trundled out to war. As early as the 1850s Fenton was commissioned by the British government to photograph the Crimean War, and Brady worked the battlefields of the American Civil War. By the First World War, photography played a key part in reporting war and and providing propaganda for the public at home. In 1991 the Gulf War revealed the scale and depth to which technologies of surveillance and so-called ‘information’ technologies had reached. The domestic television set became the mesmerising end point of an electronic image chain which started with a digital camera travelling on the nose of a smart bomb (Druckery 1991). Immersed in real-time simulations, pilots attacked by computer and video, functioning as components in the virtual domain of the military technological system’ disembodied and dislocated from material reality. Visual surveillance systems have become simulation systems. The gathering of data and intelligence was converted into a real-time digital image of war which paralleled an awful reality that few of us in the West could know or, mercifully, experience.

A highly selective and orchestrated spectacle of this war, at least partly derived from the same material, was relayed to the domestic television set. When Paul Virilio called this war ‘the first totally electronic war’, we can, as Ian Walker (1995) has pointed out, take this phrase ‘in two ways, to describe how the war
was fought and how it was represented'. At many points these two aspects came together, as 'the most potent images were those taken by the military themselves' which were then relayed on through the world's media. The journalists and war correspondents, like the rest of us, saw the war mainly on television. Photographers were reduced to taking pictures of military personnel pointing to video monitors at prearranged press briefings. However, the 'invisibility' of the Gulf War and the highly mediated nature of the images received is squarely in the tradition of 'self censorship [imposed] in the name of social cohesion' which has been part of war reporting and photojournalism from the Great War to the Falklands (Taylor quoted in Walker 1995).

Ian Walker has also argued that in this new context, where the photographer is removed from the scene of cybernetic warfare and its electronic reporting, photography continues to play a role in offering us a view of events 'in considered retrospect' (Walker 1995). Considering Sophie Ristelhuber's photographs of the aftermath of the Gulf War, Walker agrees with Taylor that it is ill-informed simply to oppose photography's old role as reportage to its recent displacement and deconstruction by digital image technology. He points instead to the range of political and aesthetic strategies which an artist like Ristelhuber brings to their use of photography. He then suggests that the future of the medium may lie in such critical-artistic interventions and not in the traditional genre of documentary photography and photo-reportage.
While we may not associate the still photograph with spectacular effect, Steve Neale reminds us that the stereoscope was one of the most popular ways of viewing photographs in the nineteenth century. Projected images for entertainment (both painted and photographic) as in the Phantasmagoria, and other environments in which transparent and backlit images were presented to audiences (the Diorama, the Eidophusikon) were very much part of the culture in which photography emerged.

All of these machines were united by their "astonishing" capacity for realism and painstakingly detailed representation. With their use of light and movement, they lured and manipulated the spectator's gaze. With the coming of electricity and mechanical music towards the end of the nineteenth century these luminous photographic entertainments became the technical and cultural antecedents of cinema, which, in one of its earliest forms - Edison's Kinetoscope - was an arcade machine designed to be used by individual viewers (Neale 1985).

More recently, two major popular forms which digital image technology has taken are those of the console-based interactive computer game for domestic use, and the 'coin-op' arcade game (Haddon 1993). By 1995, the magazine CD Rom Today reported that the gross US turnover for computer games had equalled that of the Hollywood movie industry (Dewdney and Boyd 1995). The interactivity which is central to the design and use of personal computers has major roots in the arcade game, the 'earliest form of interactive software to find a mass market' (Haddon 1993). The imagery of interactive CD-Rom also strives for the high resolution of the photographic image in combination with full motion video and stereo sound. These are held in audio-visual structures, exhibited on luminous screens, which invite the individual viewer to navigate in and out of parallel or forking narrative paths which frequently draw upon a range of traditional narrative genres borrowed from cinema or television.

In these ways digital CD-Rom can be understood as a developed electronic version of many preceding forms of visual entertainment which has, as one of its roots, these nineteenth-century forms of photographic entertainment and spectacle (Dewdney and Boyd 1995).

PHOTODIGITAL: TAKING STOCK

We have seen in the previous pages that the earlier, and still influential, attempts to gauge the significance of digital imaging for photography focused upon the differences between the analogue and the digital image, and between practices of representation (photography) and simulation (computer graphics) as the key issues. They argued that shifts from analogue/representation to digital/simulation were the visual expression of an underlying shift from a modern to a postmodern world and the loss of the kind of world-view that photography had provided since the mid-nineteenth century. A new
post-photographic era in visual culture was being ushered in, in which we could no longer cling to our fragile if tenacious belief in the truth and evidential value of photographs. At the same time a range of historical antecedents had been brought to light which pointed to cultural continuities in the uses of photography which cut across its many technological developments.

It now seems clearer than ever that the 'logic' of digital photography contains a tense relationship between continuity and discontinuity. While digital image technology may be replacing the photographic apparatus it is also playing a part in continuing and even raising the value of the photographic image so that thinking in terms of absolute differences between the two hardly makes sense. We can see a more complex interplay taking place. By any account we are faced with a situation which cannot be reduced to simply thinking in terms of the replacement of one medium or image technology by another. As Lev Manovich puts it,

'The logic of the digital photograph is one of historical continuity and discontinuity. The digital image tears apart the net of semiotic codes, modes of display, and patterns of spectatorship in modern visual culture – and, at the same time, weaves this net even stronger. The digital image annihilates photography while solidifying, glorifying and immortalizing the photographic.'

(Manovich: 2003: 241)

On this note, the rest of this chapter will consider more recent challenges and refinements to the ideas considered in earlier sections of the chapter as it is now possible to think through what has occurred in more measured and nuanced ways. We now find a situation where the digital has:

- continued to make us puzzle over the source of photography's realism;
- renewed an interest in photography's indexical nature;
- given rise to a new interest in the identity of the viewer of 'post-photography';
- required us to think about the reception, rather than the production, of digital photographs;
- led us to question, in the light of practical experience and use, the earlier abstract thinking that was brought to bear on the analogue/digital difference;
- suggested grounds for conceiving of a 'post-human' vision (replacing an earlier preoccupation with the resonance between 'post-photography' and the postmodern).

**Remembering photography's nature**

It has been a remarkable aspect of the emergence of digital image technology that it has led us to reappraise how we have understood photography and to
revisit old questions and debates about its realism. Sarah Kember (1998: 17) points to a conundrum which is one of the main reasons for this:

Computer manipulated and simulated imagery appears to threaten the truth status of photography even though that has already been undermined by decades of semiotic analysis. How can this be? How can we panic about the loss of the real when we know (tacitly or otherwise) that the real is always already lost in the act of representation?

Why then, does computer manipulated and simulated imagery appear to threaten a practice that is already recognised as one of mediation and manipulation? In the section Digitisation and the commodification of images, we met Rosler's argument that manipulation was integral to photography as seen in the very earliest uses of multiple negatives by photographers like Oscar Rejlander and in the openly manipulative, alternative traditions of photography, represented by photomontage and the work of the Dadaists and John Heartfield. Subsequently, Manovich has asserted that 'Digital technology does not subvert "normal" photography because "normal" photography never existed' (Manovich 2003: 245). Batchen (2001: 137) also argues that photography is nothing if not a history of manipulated images.

In different ways, both Kember (1998: 17) and Batchen (2001: 139–43) have argued that a tenacious belief in photography's realism is due to a strong historical investment in the idea. We must look to the history of image making and the 'way of seeing' that it embodied that we traced earlier in this chapter (A new way of seeing and the end of the 'Cartesian dream?

**Our belief in photography's realism**

We saw earlier that photography is part of a scopic regime that is far wider and has a much longer history than itself. We must now consider the cultural identity of the 'viewer' who sees in this manner. At the centre of this history of Western visuality stands the humanist self. This is a conception of the human subject who, amongst other things, is understood to be the rational centre of the world and the prime agent in seeking its meaning and establishing its order. We described this humanist subject as one who has searched for certain and objective knowledge through a disinterested and rational method of enquiry.

In her own reflection on the question, Kember stresses that this subject and this scopic regime are part of a larger scientific system and mode of enquiry, 'fashioned in Enlightenment philosophy and by Cartesian dualism and perpectivalism' (1998: 23). It is a system in which the viewer is understood as a centred, knowing subject coaxing information from a passive supine nature. However dominant this rational–scientific system and the centred humanist subject became over a period of some 500 years she reminds us that this position was always unstable and gendered. It was gendered because
typically the 'knowing subject' was figured as male and 'supine nature' as female—see Figure 7.5). It was unstable, because it was a system that depended upon (and was simultaneously troubled by) a desire to exercise power and control over nature and over others. Seen in this context we can understand that our 'panic' about the computer's threat to photography's realism does not actually take place at the level of the image itself. It is cultural panic over the potential loss of our centred, humanist selves, with our 'dominant and as yet unsuccessfully challenged investments in the photographic real' (Kember 1998: 18). The perceived threat is to our subjectivity, where a more fundamental fear is triggered which concerns, 'the status of the self or the subject of photography, and about the way in which the subject uses photography to understand the world and intervene in it' (1998: 18).

Digital photography (or digital imaging) has clearly shown us that even if the mechanical camera and chemical film are no longer involved, a practice and a form of image production persists that can be called photographic (or at the very least post-photographic). We have now seen that the value of photography depends upon more than its technology or the way it 'looks' but also upon our historical, cultural and psychic investment in it as a way of seeing and knowing. It affords us a position, an identity, a sense of power, and it promises to meet our desires. So, as Batchen (2001: 140) suggests, photography is more than its machines, it is also an 'economy of photographic desires and concepts'. At the centre of this economy is a desire to be securely placed as observers in relation to objects which interest us. For over 150 years we have gone to photography to give us reports on nature, to produce knowledge of others, to arrest time, to document and remember, to bring the spatially distant closer (to travel in space). Overall, we have looked to photography to provide a picture of a reassuring world in which every thing appears to stay in its time, space and place (Kember 1998: 2). As long as such interests and projects are pursued by human beings, then surely a photographic culture of one sort or another will ( . . .) endure despite the fact that computers may replace cameras and film (Batchen 2001: 141).

Kember's account of photographic realism as part of a long humanist investment, and Batchen's concept of a 'photographic economy' which contains a set of enduring human desires and concepts, remind us why the single most important medium in modern visual culture cannot simply be swept aside by technological change. However preoccupied we have become with the technological and signifying differences between photography and digital imaging we are also called to think about the strength of the human (humanist) values which will direct our use of either. Yet, as we shall see below, arguments are now made which suggest that a new kind of vision and new kinds of images may displace photography precisely because the old, settled concept of the human as absolutely different and other to technology is, itself, under attack.
The force of the indexical image

We dealt earlier with the over-played idea that realism is more a property of some kinds of photograph than of (some kinds) of digital image, an idea that was at the centre of many early estimations of their difference. Photography's indexical quality also played a part in those earlier comparisons, in that the photograph was seen to have a fixed and mechanically guaranteed link with what it depicts while the digital image tended toward the artificial, the constructed and simulacral. Much was also made of its novel 'immateriality' in the sense that a photograph could exist as an electronic file. (See Box D Analogue and digital.)

The value that we have traditionally placed on the indexical nature of the mechanical and chemical photograph is an important part of the 'photographic economy' we have just discussed. It is also a quality that is closely associated with beliefs in photography's realism but which needs thinking about in an entirely different way. The resources to do this have been to hand for some time (Barthes: 1980) but it is the puzzles thrown up by digital image technology's relationship to photography that have sent us back to think again. A compelling feature of chemical photography is the manner in which a photograph is caused by the light travelling from an object; in other words, that it is an image that is caused by what it represents; as the footprint is to the foot. In making the same point, photographs have been described as being like stencils off the real (Sontag: 1979). However, these 'stencils' or traces are ones in which any reality content or verisimilitude has been transcribed, manipulated, enhanced, suppressed or emphasised by the mediating processes of photography yet they remain traces or indexes, nevertheless. Such traces could be in fact quite minimal in terms of verisimilitude or information about what they represented, being little more than smudges and marks on paper which we struggle to decipher.

While it plays a part in forming our beliefs in photography's realism, photography's indexicality is, in fact, something quite different from realism. The indexical quality of a photograph has more to do with a sense of presence than realism. It testifies to the being or existence of something that was once before the camera. The photographic negative was once, as it were, in touch with the object it depicts. Clearly, this indexical quality of a photograph can coexist alongside its mediations. The ideas that a photograph constructs and leads us to have about some-thing, (or person, or event) through its mediations and codes, whether they are 'true' or 'realistic' or not, can be accompanied by a powerful sense that this thing 'has been', does or did exist (Batchen 2001: 139). Hence, even given the theoretical knowledge and critical understanding we may have about the impossibility of photographic representations capturing the 'real', we nevertheless 'sense' the real in a photograph. We 'feel' the presence of the real. This indexical quality is a characteristic of the photographic image which resists and is untouched by
our very understanding that what is before us in a photograph, is very far from a simple reality or truth (Kember 1998: 31).

Traditional photographs are material, and usually portable objects. In considering photography's indexical proximity to the 'real', it is important also to think about this materiality. A photographic print is both like a 'stencil' and is a physical object itself. Photographs frequently take the form of small things we have and keep, which we can carry with us and look at in the absence of what they depict. Putting photographic indexicality and materiality together we get a powerful mix; we see the photograph as something which it is as important to hold, touch, feel and check for as it is to see, and which we sense has literally touched something that exists but is absent or has existed but is no more. This is the photograph as a modern kind of fetish; it stands in for or displaces something lost or unattainable but desired (Kember 1998: 210).

However, digital photographs can also be indexes in both a technical way and, possibly more importantly, in how they are received and valued. We will consider this below as part of a wider discussion of the reception of digital images.

The reception of digital images
In ch. 1 (pp. 30–3), it was noted that in his book Camera Lucida, Roland Barthes was interested in the act of looking at photographs rather than their production. He was interested in the meaning or indeed, the feelings, we have about photographs which remain of people once known to us, after their death. In thinking about photography this way we move to consider the reception, rather than the production of photographs; and to reflect on our felt experience of images rather than the analysis of their signifying means. When we do this, the difference between the chemical and the digital photograph again ceases to be important.

The significant differences between the purely photographic and the digitally registered photograph lie in the way it was 'taken', registered or transmitted, not simply the way it looks. Hence, in thinking about 'pre' and 'post' digital photography we are not always faced with evident and visible differences in the images themselves. This is because of the capacity of the new image technologies to register, carry, mimic, or simulate photographic images in increasingly undetectable ways. Over the last decade of 'digital photography' this has become more and more clearly the case. Far from always being used to produce images of a montage-like heterogeneity, digital imaging technology is just as likely to be used to make images that are as traditionally coherent in their pictorial unity and exhibit the pictorial values of traditional, chemical photographic prints. Similarly, in the case of the impact of digitisation on archive images, picture libraries and image banks, the critical issues are ones of access, transmission and the use of images which continue to look like photographs.
Jay David Bolter and Richard Grusin (1999: 105–12) extend this point when they observe that digital photographs are intended to be received by their viewers as photographs. It matters not whether an image was captured by the photosensitive cells of a digital camera (clearly a form of indexical registration), or, perhaps more surprisingly, was a conventional photograph that is subsequently scanned by a computer and altered, or is a combination of two digitised photographs and computer generated elements. All of these images address us as photographs. Digital photographers want us to regard their images 'as part of the tradition of photography' (Bolter and Grusin 1999: 105). These are all images that are advertised or presented to us as photographs. They are all intended to be part of the tradition of photography. When we see any of these images we see, phenomenologically, a photograph; an image that has all the marks of a photograph and calls us to read it as a photograph, that depends for its sense on the capacity of viewers to read photographs. Further, Bolter and Grusin argue, digitising the light that comes through the lens of a digital camera is no more or less artificial than the chemical process of traditional photography. A photograph's tonal values may be altered by the algorithms contained within a piece of computer software or by the length of time it is immersed in chemicals. It is a cultural judgement to say that one of the images is more true than the other. In short, 'whether the image is mechanically or digitally produced is irrelevant' (Kember 1998: 11).

It is also the case that many photographs do not operate, or are not valued, as indexes (even if they are). It is quite possible to 'read' photographs as other than evidence of concrete things that existed in a specific time and place. As Manovich observes, 'A photograph as used in an advertising design ... does not say ... this hat was in a room on May 12'. Rather it simply represents 'a hat' or 'a beach' or 'a television set' without any reference to time and location (Manovich 2003: 245). Thought about this way the difference between certain kinds of photographs and paintings, let alone digital images, no longer holds.

**Does digital photography exist?**

Another kind of criticism of earlier ideas about the revolutionary impact of digital imaging upon photography has emerged. It again qualifies the degree of difference between them, and it flows from a continuing suspicion of arguments that are based upon abstract principles and technical differences. In the mid-1990s, Manovich and others (see Robins 1995, Lister 1995b, Kember 1998), pointed out the flaw of restricting the discussion of digital technology's effect upon photography to its technical means alone. They objected, in particular, to the habit of inferring cultural consequences directly from technological differences. In 'The Paradoxes of Digital Photography' Manovich pointed out that two key points of difference between photography and digital imaging, which were made much of by Mitchell (1992: 4–6), while correct
in technical principle, have no cultural significance (Manovich 2003: 242). These differences were:

(i) that there is no hierarchy between a digital original and its copy;
(ii) that the information encoded in a photograph is indefinite and continuous while in a digital image it is precise and definite. Enlarging a photograph reveals more information (if at the loss of resolution) while enlarging a digital image reveals none.

Neither, observes Manovich, matter in practice. In the first case, due to the file compression used in storing and sending digital images, (a necessary and normal practice in digital production now central to the economy of new media) loss of data and degradation of the image routinely occurs as files are copied and circulated. Practically, it makes no sense to say that digital technology makes the 'flawless replication of data' (ibid: 243) possible and that a digital image has no original or copies. In the second case, the high resolution capable by modern scanners means that the amount of information or detail contained in a digital image records, 'much finer detail than was ever possible with traditional photography' (ibid: 243). Effectively, it surpasses human interest in that detail or our cultural need for it. This is a good case of abstract theory being correct in its own terms while shedding little light on practice. Mitchell's 'differences' may be correct in principle but, 'if we consider concrete digital technologies and their uses, the difference disappears. Digital photography simply doesn't exist' (Manovich 2003: 242).

**Photo-realism versus post-human vision**

So far, in 'taking stock' of more recent thinking on the photodigital, we have noted a marked tendency to refute, or at least minimise the earlier claims for a radical difference. Finally, we turn to note another line of thought which, arguably, paints a more revolutionary picture than any of the thinking we have met so far in this chapter.

The computer is a kind of universal machine; it can assume the function of many other machines, including the camera, a machine that takes photographs. This capacity may be distributed across the silicon chips that compute the operations of a digital camera, which itself is connected as a 'peripheral' to the processing power in a PC, and to others such as scanners, printers and data-projectors. There may then be an optical lens trained upon the world of physical things but it is deeply enmeshed in digital technology. In the case of the simulation of photographic images by 3-D computer graphics software this optical relationship to 'things' in the world is replaced by knowledge of their physics and of photography (its optics) stored in the computer and its software. The computer knows what something in the physical world would look like if it were photographed. This last point alerts us to the fact that whatever else computer generated 'photographs' represent
they also, always represent or refer to, the look of photographs (Batchen 2001: 140). Digital images become signs for photographs, which, as we discussed above, are themselves, signs of the 'real'.

A good example of this is now found in the employment of computer graphics in contemporary cinema. 3-D computer graphics as it is used in contemporary cinema has realist goals. In many cases, the aim is to make a fantastic proposition appear realistic. The standard of realism it seeks is 'photorealism' – the look of something when photographed. As Alien (1998: 127) observes:

In cases where a real-life equivalent is clearly impossible, such as the morphing effects in Terminator 2, the pictorial quality of the effect must be sophisticated and 'photo-realistic' enough to persuade the audience that if, for example, a tiled floor transformed into a human figure in real life, it would look exactly like its screen depiction does.

To achieve the seamless integration of computer simulated scenes with cinematography of real scenes, the clinical images produced by the computer are deliberately degraded and rendered 'photographic' by closely guarded algorithms which are the industry's stock in trade (Manovich 2003: 247). These add 'noise' to the pristine computer image in the form of distinctive photographic qualities: areas of soft focus, depth of field, lens flare and halation, added to ensure the 'reality' of the image. If computer graphics succeeds in creating realist illusion it does so by borrowing 150 years of photographic history in which time we have come to accept the images of photography and film as images of the real (ibid: 246). In this aspiration of computer graphics to be photo-realistic the photographic image is newly valued as the very sign of reality at the same time as it is, in part, displaced in the technical production of the movie (ibid: 246–8).

But what of the computer simulated images themselves? If not adjusted to match the look of photographs, they are photo-unrealistic in their hyperreality, and free from the limitations of human and camera vision. 'What vision is this?' asks Manovich (2003: 248). His answer is that they are representations of a cyborg vision; the vision of a hybrid human-machine. Indeed, it is argued that Manovich's 'cyborg body to come' is with us already, as Batchen recognises, when he points to digitisation, prosthetic and cosmetic surgery, cloning, genetic engineering, artificial intelligence and virtual reality as signs that the old category of 'the human' may no longer be with us in any seeded way.

As such, they are representations of a future vision, when human sight will be augmented by computer graphics. Even the gaps and imperfections of computer images are not 'unreal' because they are the images of another kind of body than the organic human one – they are of a cyborg body yet to come. In the 1930s Walter Benjamin claimed that 'evidently a different nature
opens itself to the (photographic) camera than opens to the naked eye' (Benjamin: 1970a: 238). Now we may need to entertain that computer simulated images are not less or more real than those of photography, they are a representation of a different reality or, in Benjamin's terms, 'nature'.

In considering the idea that different realities open themselves up to the human eye, the camera, and now the computer, we are yet again returned to the Cartesian or humanist scopic regime we discussed earlier in this chapter. We must now entertain the idea that we live amidst large shifts in how we understand the world and our place within it. Ones in which the very security of our traditional distinctions between nature and culture and human and technological are dissolving.