Until the middle of the twentieth century print production remained a labour intensive process. The traditional work practices that had existed since the mid-1800s remained largely unchanged and the workforce was strictly demarcated along work role and gender lines. Production processes and the material form of books continued to change throughout the twentieth century, which finally saw an end to the dominance of relief (letterpress) printing as the primary method for the production of text, with the shift to offset lithography in the second half of the century, followed by the rise of digital printing at the end of the century. Printing had long been a heavily unionised trade, but the period also saw the breakdown of union structures in the printing industry in common with other ‘craft’ trades such as engineering, steelmaking and coal mining. This chapter will explore the technical innovations and other changes in book production in the twentieth century, and consider the implications that these advances had for the workforce that produced the printed word.

Machinery and typesetting

The nineteenth century had been one of change and innovation in the printing trade. At its beginning, wooden presses operated by hand, and familiar since the days of Gutenberg, were universal, and all type was set by hand and distributed by hand after use. Illustrations were produced from etched or engraved metal plates, or from wooden blocks; paper was produced by hand, limiting the maximum size of the sheet; printers made their own ink. In general the organisation and processes of the print shop would have been familiar to Gutenberg. By the beginning of the twentieth century, hand presses in book production, now made of iron, were used only for

1 McKitterick, ‘Changes in the look of the book’.
proofing, and the application of water power and steam power and later electrical power to presses had increased the speed of output, as had the introduction of the rotary principle. It had become possible to print on the larger sheets of paper (or from the continuous reel of paper known as a web) because of the greater speed and the greater force that could be applied to the platen. This change (the production of a continuous web of paper which was then wound onto a reel) was the result of the mechanisation of papermaking, and reel-fed printers became especially common in the production of newspapers and magazines.

The era of hot metal

Despite the many attempts at mechanisation, the setting of type by hand remained the dominant process into the twentieth century, although printing firms had long known that it was impractical to continue setting type in this way. Compositors were highly skilled, but setting type by hand was time consuming and labour intensive. Inventors had made attempts throughout the nineteenth century to mechanise typesetting, but successful typesetting machinery first came into general use in the printing industry in the final quarter of the nineteenth century. The earliest of these was Ottmar Mergenthaler (1854–99), a German watchmaker who emigrated to the United States, who in 1872 began to work alongside an American engineer James Clephane (1842–1910) and by 1884 was successful in inventing the Linotype (line o’ type) machine.

The Linotype machine was worked by a single operator who sat at a keyboard (similar to a typewriter). As a key was struck, a circulating brass matrix was brought into the line of type and automatically spaced. The face of the matrix contained the letter, number or punctuation mark which would form the impression. Whole lines of type were then cast in a single ‘slug’ of type metal. The matrices were returned to the magazines they had originally come from, to be reused. The use of hot metal casting, with type being cast specifically for the text being set, before being melted down for reuse, not only speeded up the pace of typesetting, which was particularly significant in newspaper production, but also did away, at a stroke, with the tedious and time-consuming business of distributing the type accurately for reuse after the text was printed.

Newspapers were the first ‘consumer’ printers to utilise this new technology and continued to be its predominant users. The first Linotype machine was installed in 1886 in the New York Tribune. Despite industry fears that there would be mass redundancies, the reality was that there was plenty of work...
for compositors as the mass consumer printing and publishing sector grew. Linotype composition was introduced into the British printing industry by the English Linotype Company in 1891. The system’s first US patents were granted in 1887, but the first commercially viable machines did not go into production for ten years. The first Limited Fount Monotype machines in Britain were installed at Wyman & Sons in London in autumn 1897. The Monotype system comprised two separate units: the keyboard (which like the Linotype machine was similar to a typewriter) and the caster. The keyboard used compressed air to punch holes in a paper ribbon, according to the sequence of keys struck by the operator. The caster operated by blowing compressed air through the paper strip to select the letters and set lines out in a uniform width. Unlike Linotype, letters were cast individually, making it possible for the assistant supervising the caster to make corrections ‘on the run’, whereas Linotype corrections necessitated recasting the whole line of type. The use of the Monotype system enabled casting of some 6,000 characters an hour, more than double the capacity of a good hand compositor.

Child records that by 1914 ‘almost all news offices throughout the country were using Linotypes, and all the main book-houses were using Monotypes’. Some printing purists disapproved of the quality of output from these machines, largely because of the uninspiring typefaces available. However, the various university presses and Francis Meynell’s Nonesuch Press, part of the Private Press movement, enjoyed excellent results and economies of scale in the 1920s. For this reason, most paperback Penguins, which had large printruns, were set on Monotype. Realising that it was important to offer a high-quality innovative service, the Monotype Corporation formally appointed Stanley Morison as typographic advisor early in 1923, although he had undertaken commissions from the company the previous year. Morison set about recutting past ‘classic’ designs as well as commissioning new fonts from designers Bruce Rogers, Eric Gill and Frederic Goudy. Morison also had his

---

4 Slinn, Carter and Southall, History of the Monotype Corporation, especially pp. 17, 34.
5 Child, Industrial relations, p. 182.
6 Slinn et al., History of the Monotype Corporation, p. 209.
most famous type cast here – Times New Roman, first used by *The Times* in 1932. By the mid-twentieth century the Monotype composing machines were found in every book printing house in the world, and long-established British foundries were losing their markets. Miller & Richard of Edinburgh closed in 1952, and eventually, in the early years of the twenty-first century, Stephenson Blake of Sheffield closed its doors. The Monotype machines went

7 For a summary of the type repertoire associated with Monotype, see Carter, ‘Typeface design’.

Figure 1.1 Monotype keyboard. (Edward Clark Collection, Edinburgh Napier University)
out of production in 1987, although spare parts and matrices were supplied for another five years.\(^8\)

*Developments in printing machines*

As well as changes in the pre-press stages through which the text and other content of a book would pass, the machines on which books were actually printed changed unrecognisably during the course of the twentieth century. In the nineteenth century the invention of the rotary printing press in 1847 by Richard Mark Hoe had transformed the production of the printed word. The rotary press machine was fed by a web of paper and the printing surface consisted of curved stereotypes (printing plates cast in metal or plastic from a mould taken of metal type) mounted on cylinders. The paper then passed under a knife which cut the paper web into sheets. One example of the widespread use of the rotary press was Thomas Nelson & Sons in Edinburgh. Following a fire at their works in 1880 the firm established a separate printing and binding works in 1907 which was using six Bauer rotary presses capable of turning out 200,000 books per year,\(^9\) producing cheap editions to reach a mass market.

However, by the beginning of the twentieth century the Miehle was the predominant printing machine, having largely replaced the Wharfedale. The Wharfedale was a ‘stop cylinder design’ consisting of a travelling flat bed holding the forme of type which passed under the inkers before passing under the cylinder to produce the impression. The Miehle (invented by Robert Miehle in Chicago in 1884) was more effective, as the impression cylinder never stopped. It continued to revolve at a constant pace as the machine contained a gear which was powerful enough to control the forward motion of the bed. The Miehle had great impressional strength, accurate register and durability and took the lead in machine printing. It was largely hand-fed at this time but later versions were automatically fed. The cylinder press makes two revolutions to each impression, rising slightly to allow the bed to pass under it on the second movement. In the large printing centres there was a desire to produce ‘fine cut and registered colour work’, giving rise to a need for a heavy-duty press which was easy to control at the point of reversal for the second impression. The 1921 Miehle Vertical had a speed of about 3,600 impressions per hour, later improved to 5,000 per hour. Between 1952 and 1968 this machine was manufactured in Goss Works in Preston.

\(^8\) Slinn et al., *History of the Monotype Corporation*, p. 174.

Developments over the twentieth century included printing on both sides of the sheet and in more than one colour.\textsuperscript{10}

\textit{Lithography}

Hot metal typesetting remained as the standard process for book typesetting for more than half a century until the 1960s when letterpress was superseded by the method known as offset lithography (or offset printing). Offset litho was first patented in 1853 by John Strather of England. The principle was not practically applied until the 1870s, when rubber offset rollers were used on flat-bed presses for printing on metals. The photo transfer process enabled a photographic image on sensitized paper to be inked from the stone that was fixed to a bed which moved to and fro beneath a cylinder and transferred to the printing surface. Six years later the first lithographic halftone screen was used in Britain. Offset methods for printing on paper were developed in the United States shortly after 1900 and the first British offset lithographic printing machine was built by George Mann in 1906. The offset lithographic presses were cylinder machines for printing from the lithographic stone or plate and consisted of three continually revolving cylinders. The first, carrying the printing plates, has a damping and inking mechanism which makes contact with the rubber blanket moulded on the middle cylinder; the blanket offsets the design to paper, carried by the third cylinder.

Initially this development was employed in magazine publishing, though by the Second World War it became more commonplace in book production, leading to a reduction in the use of relief printing. Increasingly books were produced using offset litho, and for those texts with long print-runs and many new impression this became the only real option, as the rubber printing surface was much more durable than relief surfaces. Still more durable options became available with the introduction of polymer printing plates.\textsuperscript{11} Lithographic printing on the rotary offset press started to print text from a flat plate produced photographically (\textit{‘phototypesetting’}), which enabled the presses to produce high-quality, finely detailed impressions at high speed, reproducing any material, text or image that could be photographed in the plate-making process. Offset litho presses were lighter and cheaper to run, and became more widespread from the 1950s. By the late 1970s and early 1980s they had become, and still remain, the dominant method of production with low origination costs, although digital presses had entered the market. Web offset litho, developed from the 1950s, is an


Sarah Bromage and Helen Williams
alternative production process. The press is fed by a reel (or web) of paper, and after printing the paper is cut into sections and folded for binding.\textsuperscript{12}

\textit{Photocomposition}

Photocomposition, which became widespread in the second half of the twentieth century, was well adapted to use with the offset printing process. Technological development meant that photocomposition had started to replace hot metal technology by the 1960s. The concept of utilising the art of photography and photographing letters to produce words was mooted as early as 1898. W. Friese-Green devised plans for a machine in which individual white letters on black background were released by hitting a keyboard and were subsequently photographed. This and other potential photocomposition machines were devised in the early 1900s, though it was not until the mid-1920s that potentially workable machines were conceived. These included Edmund Uher’s 1927 glass cylinder model, the American 1929 Luminotype machine which claimed to be able to set 7,000 words an hour, and W. C. Huebner’s 1939 glass disc machine, which was followed by R. Higgonnet’s disc machine with electronic memory (1944). The first machine to go into commercial production was the Dutch Hadego machine (1948), which was designed primarily for display work,\textsuperscript{13} and the Rotophoto launched concurrently with the installation of the first Intertype photosetter in 1950, which heralded the widespread use of photosetting.\textsuperscript{14}

By the 1960s there were various different forms of photocomposition which were slowly being adopted into printing firms in the UK including Photon, Linofilm, Monophoto and Fotosetter. These all worked on the same basic principle of setting type by photographing characters on film from which printing plates were made. The characters were then developed as photographic positives on film or light-sensitive paper from a negative master containing all the characters; the film, carrying the completed text, would then be used for making a plate for printing.

Systems like Monophoto and Fotosetter used existing technology and adapted it to meet this new concept. The Monophoto was launched by the Monotype Corporation in 1954. This machine was a photocomposing machine and was the counterpart of the Monotype composition caster. Instead of casting columns of individual pieces of type from molten metal, it produced exposed photographic film or paper ready for development.\textsuperscript{12}

\textsuperscript{12} Steinberg and Trevitt, \textit{Five hundred years of printing}, p. 221.
\textsuperscript{13} Clair, \textit{A chronology of printing}, p. 186.  \textsuperscript{14} Larken, \textit{Compositor’s work in printing}, p. 172.
The character images were still carried on a matrix. However, instead of molten metal the characters were exposed to a photo sensitive film or plate to produce a photographic proof. The work to be produced was then made up on an illuminated glass screen, and either offset or etched plates could be produced from the resulting image. This gave the printer increased flexibility in terms of typefaces and spacing, which was limited in Monotype machines. However, in the first incarnations it was difficult to correct type. The whole line containing a single incorrect letter had to be re-keyed and re-exposed, and the new section of film taped to the original. This soon moved on and by the later 1960s the machines could be driven by keyboards producing correctable punched-paper type, which effectively streamlined the process.\(^{15}\)

In the 1960s developments in hardware and software, and reductions in the costs and size of the machines, meant that the application of computers to the typesetting process became commercially viable for the printing trade. Developments in computer-aided typesetting were closely linked to improvements in the process of photocomposition (which produced a printing surface from a photographic image of the imposed page). The Fotosetter was introduced in the United States in 1945 and was a development of the hot metal line composing machine the Intertype. It retained the circulating matrix and the mechanism for matrix assembly and distribution, but in place of the metal pot there was an optical system for the projection of characters on film. Intertype installed the first Fotosetter machine in the UK in 1956 in the Printing Department of the Corporation of Glasgow, and one of the earliest phototypeset books produced in the UK, an edition of Eric Linklater’s *Private Angelo*, was set on an Intertype Forrester machine and printed by McCorquodale & Co. of Wolverton in 1957.\(^{16}\) These early systems relied on punched tape created at a keyboard: the tape was processed before being used to produce a relief printing surface with familiar hot metal technology. By 1968 the Compugraphic was able to perform line-end word division.\(^{17}\)

Linofilm and Photon methods instead chose to adopt new technology rather than adapting to existing systems. The Linofilm was first exhibited at the 1958 DRUPA international printing exhibition in Dusseldorf. It consisted of a keyboard and a photographic unit. The keyboard produced a perforated tape and proof; the tape was used to control the photographic unit.

\(^{15}\) Slinn et al., *History of the Monotype Corporation*, pp. 117–18.


\(^{17}\) Steinberg and Trevitt, *Five hundred years of printing*, p. 224; Bann, *The all new print production handbook*, pp. 12–14.
The benefit of the Linofilm system was that the two units were completely separate, which meant that the photographic unit could often manage the work of several keyboards. The Photon system alternatively was comprised of three units: a setting console, a relay rack which controlled the spacing and tabular settings, and a photographic unit. All three units were controlled by one operator who could make corrections during the process.

In parallel with these developments, changes in print production technology (printing surfaces and the offset litho process) and increasing use of micro- or personal computers meant that by the mid-1980s much of the initial preparation of text and illustration for reproduction no longer took place within the printing house at all. Thus, for the printing industry the introduction of phototypesetting was not necessarily good news, as although it eliminated storage of large formes of type and essentially produced film that was storable and reusable, it also involved large-scale expenditure in an industry that had not long invested in hot metal technology. The technology developed quickly and many firms which had invested in the first phase of phototypesetting found it quickly superseded.

The use of photocomposition also meant retraining for a workforce which in some cases had only just adapted to the use of hot metal. Photocomposition required the compositor to undertake his make-up with pieces of film rather than type, and to work on a light table rather than an imposition surface (fig. 1.2). Although the basic job remained the same, the skills used to achieve this had changed markedly and required a new generation of composing skills. Further technological developments meant that the second generation of photo-setters were able to vary the leading from line to line and make the first moves towards the computer-assisted page make-up.

Illustration, ink and binding

Illustrations in books had until the middle of the twentieth century been printed by a separate process from the text, and were often grouped together as a set of plates for binding. Developments in the typesetting process, however, facilitated the integration of text and images, although it was late in the twentieth century before this became common, with the widespread use of offset lithographic presses. In traditional page make-up the integration of images into a printing forme was a laborious process which involved making up the page using type and plates held in place by furniture (wooden

18 Wallis, ‘Seven wonders’. Later developments are discussed below.
or metal pieces used as spacing material). Lithographic images came to be employed, requiring the use of a particular limestone. The fundamental principles established in 1796 by Alois Senefelder, the inventor of lithography, remained unchanged in the twentieth century, although other substrates gradually came into use. By writing or drawing with a greasy ink on a specially prepared slab of limestone, the grease is absorbed by the stone and the image thus formed has an affinity for printing ink, while the remaining parts of the stone repel the ink as long as the surface is kept moist with water.

After the invention of photography in the mid-nineteenth century, the use of photographic techniques for reproduction allowed more visual images to be produced and led to dramatic technological innovations taking place. By the 1870s it became possible to use photography to produce line drawings and other black and white images. However, it was not possible to reproduce shades of grey. This was remedied by the use of a halftone screen, which broke down the tonal image of the photograph into a series of small dots. The dots varied depending on the amount of light passing through a mesh of lines engraved on glass. The negative was exposed onto the plate through the

Figure 1.2 Positioning type. (Edward Clark Collection, Edinburgh Napier University)
screen, resulting in a halftone block broken into raised dots of greater or smaller size in correlation to the light and dark areas of the photograph. When printed, the dots reproduce the light and dark area of the picture. This led to a change in the type of book produced as commercial printers could use art paper to produce books with many illustrations, usually inserted as a section in the centre of the book.

This method was also later used to reproduce colour photographs, initially using relief printing surfaces, stereotypes and electrotypes. Electrotypes moved to plastic materials for the printing plates in the 1930s, an innovation which gave book designers greater freedom to develop page layouts and made the production of books significantly cheaper. Colour printing, however – although made cheaper by these improved pre-press processes – remained relatively expensive, as printing in colour continued, and still continues, to require additional inks and more complex printing machines. However, with these innovations, publishers could utilise new technologies to produce vibrant and innovative books at affordable prices.¹⁹

Ink had traditionally been made of a combination of linseed oil and lamp-black. The changes in the technology of printing demanded different inks. Coloured inks had been employed mainly for the hand colouring of illustrations, but with the introduction of aniline dyes in the nineteenth century following advances in the chemical industry, especially in Germany, a wider range of tints became available. As print-runs increased, colouring images by hand was no longer viable, and experiments were made with engraved and lithographed images. Photography of the original image, using filters to separate out the colours, produced improved results, but the necessity to print each colour separately to produce the final image meant that colour printing continued to be an expensive process. It was only with the changes to offset litho as the dominant printing process in the latter part of the twentieth century that coloured illustrations, integrated in the text (not as a separate run of plates), became commonplace anywhere other than in children’s books, although the addition of colour to the printing processes still added significantly to costs.

The form and process of binding also changed. At the beginning of the nineteenth century binding was almost entirely a hand process, and had changed less by the beginning of the twentieth century than most of the other aspects of book production. However, mechanisation of the process generated changes in the finished product, notably the rise from the 1930s

¹⁹ Feather, A history of British publishing, p. 211.
onwards, co-existent with the rise of paperbacks, of so called ‘perfect bindings’, where instead of the sheets being folded, collated and sewn, the pages are guillotined and glued into their covers.

The printing industry

In the early twentieth century, printing and publishing were still often undertaken within a single company. Print houses often combined the process of commissioning, printing, publishing and selling under one roof.20 However, the separation of book production from the publishing process had begun early in the nineteenth century, and by the end of the twentieth century few book publishers other than the Oxford and Cambridge university presses still retained a printing operation. Well-known names survived as publishers, having sold or closed their printing operations. Some specialist book printing firms, such as Clays of Bungay in Suffolk, or R. & R. Clark in Edinburgh, had rarely if ever published under their own imprint, but focussed on book production for those publishing houses which had no production facilities of their own.

Printing processes involved a variety of work roles. Traditionally these had been strictly segregated, and print unions had come to control how many employees could work in a firm, how many apprentices could be taken on, rates of pay, and working conditions. In the pre-production stage, firms employed compositors and readers. In the machine room there were the pressmen (sometimes called machinemen) and their assistants and post production was the bindery, which was the only area of book production where women predominated. In addition there were semiskilled and unskilled workers, under the direction of the time-served journeymen, especially in the press-room, and in other aspects of the business such as stereotype foundries and warehouses. Each trade had its own individual work conditions, hours of work and rates of pay. In the twentieth century, entrants went through the Printers’ Exam and their apprenticeships lasted seven years for males (later six) and four years for females, after which they became journeymen. Women’s entry to traditional craft areas such as typesetting was strongly resisted by the men until the final third of the century.21

21 For two accounts of this, see Reynolds, Britannica’s typesetters, and Cockburn, Brothers.
The impact of war

Both the First and Second World Wars had a dramatic impact on the printing and publishing industries in terms of both manpower and the availability of raw materials. Not only were the metals required for typecasting and printing plates rationed by demand elsewhere, paper was also in short supply, because by this time much of it, or the raw materials used to manufacture it, was imported. During the First World War, in 1916 a government Royal Commission on Paper limited imports of paper and papermaking materials to two-thirds of those of 1914, and appointed a commission to oversee the licensing of imports and ensure that supplies of paper were allocated fairly throughout the trade.\(^\text{22}\) In the Second World War, supplies were controlled by the ‘paper controller’, who decided what could be produced and where it would be allocated. These controls came into force on 12 February 1940 and paper producers were prohibited from supplying ‘more than 60 per cent of the weight of paper consumed by any single user in the same three-month period (March–June) the previous year’.\(^\text{23}\) By this period many papermills relied substantially on imported esparto grass from North Africa and Spain as the raw materials for pulp. In 1939 Britain imported 272,000 tons of esparto grass. By 1942 imports had ‘fallen to zero’.\(^\text{24}\) With no available imports, many mills struggled to find sources of cellulose and took to using potato haulms, tomato plants, rope or straw as their raw materials, which had its own impact on the quality of material produced. Holman records that by June 1943, ‘twenty-eight mills in England and Wales were using straw, as were eleven in Scotland, while the Ministry of Supply was consuming 300,000 tons of straw a year in the manufacture of paper’. Paper control remained in place until 1956; this had a long-term impact on the industry and heralded the slow decline of papermills in the UK throughout the rest of the century.

In addition to problems with the source of paper there were issues with the availability of type and the metals used to produce printing plates. A large proportion of standing type which would have been used in reprints was increasingly donated by firms over the course of the war and melted down and used for weapons and other essential war work.\(^\text{25}\) Zinc and metal, used for plate-making, were also essential to the war effort, meaning that illustrated books with screened halftone photographs were more difficult to

\(^{22}\) Howe, *The British Federation of Master Printers*, pp. 51–2; Gennard, *Mechanical to digital*, p. 75.


produce, and publishers began increasingly to use line blocks for illustration as these used less metal.26

Conscription during both wars led to manpower issues and contributed to ‘dilution’ of labour, or the employment of individuals without traditional craft training in craft roles.27 During the Second World War ‘nearly half of the Typographical Association’s thirty-two thousand members were moved to munitions work or called up’.28 Overall, there was a reduction of available labour and decline in output. However, dilution meant that in many large printing firms women undertook the ‘traditional male role’ of composing and printing during wartime, before transferring back to their traditional roles, for example in the binderies, during peacetime.29 Printing firms also participated in the war effort. The Glasgow firm of Blackie gave over a third of the floor space in their Bishopbriggs works to armaments production and staff from their bindery transferred to the munitions labour force, and in Surrey the Monotype factory was producing machine gun components and Hurricane aircraft.30

There were problems with the supply of new machinery which had an impact on papermaking and printing machine manufacturers. For example, in 1934 the German printing machine manufacturer Heidelberg introduced a fully automatic high-speed cylinder press to the market and 60 per cent of the company’s revenues from their base in the UK came from foreign sales. Trade with the USA and Germany was not possible in wartime conditions and the company accepted orders for precision lathes and hydraulic devices to supplement its income during this period. Other firms such as the Edinburgh papermaking machine manufacturer Bertrams suffered during wartime conditions as the resources of the company were directed largely to armament work. Only essential maintenance of papermaking machinery could be undertaken, and company records show that several papermaking machines sent overseas during wartime did not complete their perilous journey. One example is the replacement wet end of a papermaking machine sent to India to further the war effort, which went down when the ship was sunk so another had to be sent.31

26 Gennard, Mechanical to digital, pp. 138–40, sets out the various controls on raw materials, 1939–45.
28 Holman, Print for victory, p. 82. 29 Child, Industrial relations, p. 287.
30 Blackie, A. C. Blackie & Son, pp. 60–1; Slinn et al., History of the Monotype Corporation, pp. 89–90, 100.
31 Within a mile of Edinburgh town, p. 18.
The availability of new machinery, however, did not pose a significant problem to the printing and publishing industry during wartime and beyond since most printing machinery was heavy-duty, durable and reparable. Large firms would often employ engineers and technicians to mend machines that could operate for decades rather than years with periodic in-house repairs. In the immediate post-war period, printing houses were slow to adapt to new techniques and many firms were uneasy about the implications that the fast pace of technology had in terms of investment, and also the impact that it had on the workforce.

*The impact of new technologies*

Until the mid-1970s, hot metal was still used in the majority of printing houses and the compositors/Linotype or Monotype operators still made up a significant proportion of the workforce. However, developments in technology, particularly the rise of offset litho and the disappearance of many of the specialist printing houses that printed books such as Thomas Nelson in Edinburgh (1967), led slowly to the specialist role of the compositor being completely eradicated. The introduction of computers to pre-press processes meant that the means by which the author produced the typescript and the typesetter set the type became one and the same process. Specialist typesetting staff were no longer needed and it became an economic necessity to dispense with this sector of the workforce.

The consequences of this technological shift had a wider significance because of the influence that the unions and the ‘chapels’ held within the printing industry in Britain. Most printing firms operated a ‘closed shop’ policy, which meant that to work in the company you had to be a union member. Unions controlled entry to the trade by limiting the intake of apprentices and there was a strong sense of belonging through membership of the local ‘chapel’, usually synonymous with the workplace branch of a print union. The chapel was presided over by the ‘Father of the Chapel’, or ‘Mother of the Chapel’ in the bindery section, who would represent employees in disagreements with management, and undertook a social welfare function for union members. The Society of Master Printers (later the British Printing Industries Federation) and the Society of Master Printers in Scotland (later the Scottish Print Employers Federation) together represented the employers in the UK printing industry. The print unions fought for their members’ rights, particularly with respect to working hours and holidays.

32 Child, *Industrial relations*. 

55
with pay and other benefits. In 1919 ‘a comprehensive set of National Agreements’ was effected by all the major unions ‘covering the basic terms of employment’ and throughout the inter-war period printers’ earnings remained ‘very favourable in comparison with those of all Industries’.\(^\text{33}\) The strength of the unions and their bargaining power with employers meant that by 1946 the Printers and Kindred Trades Federation had negotiated two weeks’ holiday with pay, making print workers the first in the UK to achieve this.\(^\text{34}\) Though this strength gave employees good working conditions, pay and holidays, it did not assist the print employers when they had to make significant changes to the workforce in direct response to changes in print technology.

In the nineteenth century, the majority of the letterpress trade societies, some of which had their origins in the latter part of the eighteenth century, had coalesced into the Typographical Association (covering England, apart from London, Wales and the whole of Ireland), the London Society of Compositors and the Scottish Typographical Association. The bookbinding and papermaking trades had likewise amalgamated into national unions. Workers in newer processes had been represented by sectional unions such as the National Society of Stereotypers and Electrotypers, the Society of Lithographic Artists and Designers (SLADE) and the Amalgamated Society of Lithographic Printers. By the turn of the twentieth century, unskilled workers were also organised into unions, having previously been excluded by criteria which included a seven-year apprenticeship. The unions representing the compositors in the letterpress trade in general succeeded in retaining control over the operation of ‘hot metal machines’ (Monotype and Linotype) and the rates of pay applying to them; they also succeeded in excluding women and ‘unskilled’ men from them more or less until the end of the ‘hot metal’ era. Proportionally more women were employed in binding and some areas of the papermaking trades than in other areas of printing and the kindred trades.

Issues such as wages, holiday entitlement, sickness and other benefits, and the ratio of apprentices to fully qualified staff were part of the National Agreement, arranged between the print unions’ national negotiating committee and the representatives of the employers, the British Federation of Master Printers, later the British Printing Industries Federation. In Scotland separate negotiations were undertaken between the unions and the

\(^{33}\) Ibid., pp. 226–9, 283.
\(^{34}\) Ibid., pp. 299–303. See also Howe, *The British Federation of Master Printers*, pp. 197–205.
organisation representing the Scottish employers. The interests of workers represented by the various competing unions led to ‘demarcation’ disputes, for example over who should work a particular machine. The situation was ultimately resolved by the amalgamation of the various unions, as technological advances showed the weakness of this state of affairs. The process of amalgamation took place throughout the twentieth century, and by the end of the century unions in the printing industry were much reduced in influence, and print workers were represented by a section of UNITE! The Union.

The existence of durable machines which had cost firms a small fortune to purchase, and were operated by skilled printers who had undertaken long apprenticeships and were protected by their unions, was not an easy obstacle for the industry to surmount. Until the 1970s, in many printing firms books were still produced on letterpress rotary machines, with type composed using the Monotype system. The advent of offset lithography as a viable technology for reproducing text, and text in combination with images, rather than images alone, changed that. However, many firms had invested large quantities of money in technology that still worked and employed onsite engineers for maintenance, and were reluctant to change work practices brought by innovations such as photocomposition and offset printing which, by the last decade of the twentieth century, had become the dominant processes for book production.

Developments after 1970

Although the method of producing a book had completely changed by the 1970s, there was to be yet another revolution in book production. The third generation of phototypesetters and the introduction by the Linotype Corporation of the Linotron 202 in 1978 offered digital typefaces stored as outline vectors, that is dispensing with photographic images and moving towards a digital storage of images which heralded the end of photographic composition and the introduction of digital technology. With increasing use of computer technology bringing desktop publishing software, digital printing began to overtake offset litho at the beginning of the twenty-first century as the quality of the end product improved.

35 Gennard, A history of the National Graphic Association; Gennard with Bain, A history of the Society of Graphical and Allied Trades; Gennard with Hayward, A history of the Graphical Paper and Media Union.
The global economic crisis of the 1970s impacted significantly on the printing industry. Printing costs rose dramatically throughout the decade. In 1975 Collins reported experiencing increased costs of 60 per cent in paper and binding materials. The heavily unionised workforce extracted high wage increases, putting added pressure on printing firms. By 1981 ‘compositors had become – after coalface workers – the second highest paid manual workers in the country’. Between 1975 and 1981 the printing industry as a whole shrank: more than 1,200 companies disappeared, and the number employed in the industry was reduced by 66,000. Book and periodical printers were the largest sector within the industry, and some of the remaining firms cut costs by moving out of town centres into the periphery, such as Collins which moved from central Glasgow to Livingston, outside Edinburgh. To cope with the change in the market and the cost of production, many publishers moved away from photocomposition to ‘strike on’ typesetting machines such as the IBM Selectic and electronic composers. These were not as high in print quality and their spacing was erratic in the initial stages. However, what they lost in quality they made up for in cost of production.

The main impediment to high-quantity production remained in the typesetting stage with the compositor, and the time needed to make up a page. By the mid-1980s many of these issues were resolved. Photo/imagesetters were now not simply concerned with laying out columns of type but were involved in the placing of images and text on the whole page, which was a radical departure and development. However, this development was soon to be replaced by the widespread adoption of computers. The use of personal computers allowed authors the freedom to type and edit text themselves and then save it to an external disc to be transferred to another machine for the next stage in the production process. It could then be reproduced multiple times, for example on a laser printer. These machines deposit toner as instructed by the computer which is then sealed by a heat process. The introduction of the Apple Mac and the IBM PC in the 1980s as ‘computer compositors’ had radical implications for all sectors of the printing industry. While previously a page with illustrations would be laid out by designers for a typesetter to implement by assembling text and images on the page, systems such as PageMaker could achieve this in one process.

and craft of typesetting became increasingly blurred with the tools used by the author to create the book, and pre-press processes were conducted away from the printing plant.

Towards the millennium, the improvements in the quality of digital printing meant that it became an increasingly viable option for book printing, especially for reprints and the short-run and print-on-demand markets, which became more economical as the need for expensive printing plates was eliminated. OCR (optical character recognition) technologies made the production of reprints of obscure and out-of-print items cheaper and quicker, though the quality remains questionable. By the end of the twentieth century, pre-press processes for book production had become almost entirely digital, with only ‘fine-press’ books still produced by more traditional methods, using Monotype castings and letterpress printing surfaces. At the same time, it had become more economic to print United Kingdom publications elsewhere in the world, transferring camera-ready copy electronically and transporting back the finished (or part-finished) items, rather than producing them from scratch in the UK.

Conclusion

The twentieth century saw a range of technological changes which altered fundamentally the way books were produced. The century saw the disappearance of many firms that had been in existence for generations and the breakdown of the large skilled workforce which produced the printed word. Many who worked in the industry may agree with the line from J. M. Barrie’s novel Sentimental Tommy: ‘The printing press is either the greatest blessing or the greatest curse of modern times, one sometimes forgets which it is.’40 Although the story of the material book in British publishing was one of development, technological advance and change, this did not always chime with the aims of the printing workforce, which often resisted both technological advance and alterations to work practices. For many firms the pace of change and the sheer proliferation of new technology made it very difficult to keep pace financially. The shift from hot metal to photocomposition and then to computerisation in the second half of the twentieth century completely bypassed the once crucial role of the compositor in the printing process. The introduction of the internet, e-books and online editions, which has

40 Barrie, Sentimental Tommy, p. 55.
characterised the last decade of the twentieth and continues to grow in the early part of this century, perhaps poses an even bigger challenge to book publishers and the nature of the material book than the technological advances of the previous century. These developments are discussed in Chapter 2.