I

A century of change

Paper, type, illustration and binding. They are not the only physical constituents of a book, but they are some of the most obvious. The present volume covers almost exactly a hundred years, when the appearance of books, the means by which they were set, printed and bound, and the materials of which they were made, all changed at a pace and to an extent not paralleled even in the application of machinery to printing and to paper-making in the first half of the nineteenth century.

Publishing and bookselling, universities and religious observance, scientific research and secondary school-teaching all changed in their practices and outlooks, in the private assumptions of those charged with their pursuit and in response to public events. They also changed in the eyes of the elusively termed general public – a phrase coming into use in the 1870s and itself contributing to structures of opinion, influence and social awareness. The following pages touch on all these issues, which helped shape and define a printing and publishing business that proudly traced its ancestry to the sixteenth century. At the centre, however, were books, the products of Cambridge University Press and the justification for its existence.

Thus to place the physical properties of books at the head of the history of an organisation encompassing both printing and publishing may well be considered eccentric. For most people, books from the Press, as from any publisher, are thought of first by their authors' names, and by their titles: printing is a secondary consideration. In any case, the two roles of the University Press, as printer and publisher, do not coincide in all their respective activities. Many books published by the Press were not printed by it; and many books printed by it were not published by it. While such divergence often caused anxiety, and even antagonism, in fact the freedom for both sides, printing and publishing, to go into other markets was a source of organisational and therefore commercial strength. In publishing, where the risks tended to be greater than in most printing, alertness to public need had always to be measured by potential competition. During the century covered by this volume, as well-known authors became increasingly valuable assets to their publishers, competition took on a multitude of meanings.

Manufacture

Between about 1890 and about 1960, the period of the last (and in some respects greatest) general flowering of letterpress printing, the manufacture of books underwent a further industrial revolution, beyond that which had occurred in the first half of the nineteenth century. The technological changes, financial and social in their implications, were in some measure responses to events originating outside the printing and publishing industries, at various periods of inflation, wartime economies, world recession and increasingly tight-knit international trade. But as in other industries, mechanical innovation and new materials both created their own demands among consumers (in this case authors as well as readers and publishers), and also were led by the aspirations of the market-place.

First, and returning to the opening words above, it is appropriate to look at the three principal features common to all books: paper, type and binding, and the fourth, illustration, found in many. The removal of tax on white paper by Gladstone in 1861 had brought widespread satisfaction among the book trades and customers alike, but it could not alleviate another, and more fundamental, difficulty. Demand for paper in the mid-century fuelled a mounting crisis in raw materials, and even with imports on an ever greater scale the supply of rags was increasingly inadequate to the needs of paper mills.[1]

> Our rags are anticipated – nay, the stock is exhausted almost before it has been turned into rags. Esparto paper, which held out large hopes to cheap paper makers, is found to produce a very fragile and inferior kind, at once when printed damaging the type and unpleasant to the sight. Nor is the stock of this grass abundant. The industry of our rag-pickers and those who buy waste paper, although widely exhibited in our streets, and brought before the public by many and constant advertisements, cannot produce material, even at second-hand, sufficient for consumption; and ephemeral literature and the daily chronicles of events demand such large supplies, that it is needless to say the production of more important and enduring books is rendered every day more difficult and costly by such competition.[2]

The search for new materials was worldwide. If esparto grew in Spain, could it not also be cultivated in southern Italy? From the West Indies to West Africa to Australia and New Zealand, indigenous plants were tested for their possibilities, though the more realistic observers noted that transport costs might mean that they could probably serve only local markets. In order to meet Gladstone's personal interest in the subject, in 1869 Sir Harry Parkes, the British Minister in Yedo, was asked to investigate paper manufacture in Japan.[3] In 1871, wood-pulp still seemed no more than a near prospect: it was not yet a commercial or practical proposition.[4] Between 1865 and 1875, paper production in the United Kingdom rose from 113,000 tons to 165,000 tons, and by 1895 it was 530,000 tons.[5] Only a small part of domestic production, as of imports, was for books; and the amount needed for magazines increased much faster in proportion than did that for book printing.

For the whole of the period covered by this volume, the paper used by the University Press was in sheets.[6] Web-fed presses, developed originally for newspaper

printing, were applied gradually to book printing, and by the early 1960s the Printing House was losing orders to competitors who could offer lower prices as a consequence. For Cambridge publishing, the small amount of work that could be put on such presses meant that investment could not be justified.

Paper quality is a fundamental issue for all printers and publishers, as well as those who read and look after books. It affects how books are printed, the quality of their appearance, their legibility, their longevity and their price. Between the 1860s and the 1960s, the paper industry underwent great changes, and for some years during the 1920s and 1930s the printing industry had an unprecedented choice. The late nineteenth and twentieth centuries also witnessed increasing collaboration between paper-makers and the special needs of the different parts of the market. The large number of mills that characterised the mid-nineteenth century was steadily reduced, as smaller mills were closed or absorbed into larger businesses. The total of paper mills declined from 451 in 1851 to 279 in 1904.[7] To the paper industry, one of the most important issues was imports, whether of raw materials (especially rag, esparto and wood) or of finished paper and board destined to compete with domestic production.

Esparto grass was introduced from Spain and North Africa into British paper-making in 1860–1, as a substitute for rag.[8] Its use in paper-making depended on its being digested in a strong solution of caustic soda, which was then washed out before bleaching powder or chlorine (typically as much as 6–8 per cent of the raw material) was added and the mixture was heated for several hours. Then the chlorine was in turn washed out, and lumps or foreign matter were strained off before the pulp was passed to the beater and so to be turned into paper. It will be evident that insufficient washing left self-destructive weaknesses in the finished paper. Nonetheless, imports of esparto had risen to over 200,000 tons in 1880,[9] and to 300,000 tons per annum just before the Second World War. Esparto was employed for board, as well as paper, and it was much more used in Britain than in continental Europe or North America. France and Germany used straw (which was treated in a similar way); in Scandinavia, Germany, the United States and Canada wood was freely available, and was used generally.

From the 1870s, wood-pulp was also imported into Britain in very large quantities, mainly from Scandinavia and much of it for newspaper and cheap magazine printing. Increasingly, it was used for papers for book printing. Between 1888 and 1898 imports rose from 111,000 tons to 405,000 tons. This had more than doubled again by 1913, and by 1933 it had doubled yet again, to 1,939,036 tons.[10] Mechanical wood-pulp, which became prominent in imports during the 1870s, and in which the fibres were broken down by machine, produced a very poor paper, with short fibres. Such paper quickly turned brown and disintegrated unless it was kept in optimum conditions that would retard the process. The longevity and strength of chemical wood-pulp, first patented in 1854 and manufactured in commercial quantities from the following decade, depended mainly on the means used to break down the wood. The sulphite process, invented in the mid-1860s, and involving

the use of acid, produced a harder paper than the soda process, where wood was digested with caustic soda. It was not made on a large scale in England until the late 1880s. Though papers produced by either process were stronger than those made from mechanical pulp, they were inherently weak thanks to their raw material (most wood has a comparatively short fibre) and to the destructive nature of chemical residues. In practice, the better book-printing papers were usually made of a mixture of materials, the addition of even a little rag to esparto adding noticeably to the quality of the finished article.

The first printing papers coated with china clay so as to provide the smoothest possible surface were made as early as the late 1850s,[11] and by the 1870s there were several mills offering these specialist papers for printing fine detail. At Cambridge, one-side coated paper was used for the Arabic frontispiece to a book printed in 1876:[12] the paper did not take the ink well, and it was some years before the Press mastered the materials and techniques. Demand for clay-loaded paper increased substantially with the development of the photographic half-tone block. There were many disadvantages. If it became damp, pages adhered together and could not be separated without spoiling: in extreme cases the pages congealed into a solid lump. It was heavy, both in printing and for the reader. Although type could be printed on it, the tendency to glare made it unattractive and difficult to read. Accordingly, plates tended to be printed either on single leaves and tipped in, or printed in sections and sewn together. The consequences for the ways in which text and illustration were thereby separated are some of the most obvious features of books printed during much of the twentieth century. During the 1920s and 1930s, as photography played an increasing role in the content of books, and typographers sought to exploit the relationships between text and image, rather than ignore them, many books were printed on this so-called art paper.

The deterioration to which paper is subject was only partially understood in the 1870s. Authorities on paper-making insisted on the importance of understanding the chemistry of their subject, though in fact few mills could be said to be wholly competent in measuring what they were doing. At that time, comparatively little work had been done even optically on the fibre structures of esparto and wood.[13] It was not until the 1890s, when quality had deteriorated still further, that basic principles were put forward for measuring the quality of new paper. Some progress towards this was made as a result of a report to the Society of Arts in 1898,[14] but it was not until the 1930s and later that deterioration of paper stocks was more thoroughly understood.[15]

In the 1870s, Britain was a net importer of paper, but the papers used by the University Press at this time for its everyday work were all of British making. The country depended for most of its medium-quality papers on esparto. In practice, many papers were mixtures of different raw materials. The rationing to which publishers were subject during and after the Second World War was the result partly of the need to control manufacturing production across a wide range of industries, and more immediately the result of a lack of imported raw materials, both

esparto and wood-pulp. After the Second World War paper for book printing was imported in increasing quantity, and the Press was but one among many customers who bought at the best prices they could obtain in what gradually became a world market.

Paper was customarily printed damp in the 1870s, so as to take up ink effectively on its rough surface. This had been the practice since the fifteenth century, and the advent of machine-made paper, followed by the development of printing machinery, made no effective difference. But, with the increasing availability of highly calendered paper (that is, paper that had been passed between polished steel rollers at a late stage in its making), by the 1890s most printers were printing on dry paper.[16] The smoother surface permitted much better detail in wood-engravings and photographically prepared line blocks, as well as in the stereo or electro blocks prepared from them. The harder surface of dry paper was also less liable to break up in fast machines and under the sharp lines that characterised many modern typefaces. Wet or dry, fragments of paper, known as 'picks', that broke away from the surface, and adhered to the crevices of type, posed a constant hazard to good presswork, since they resulted in blotches on the finished page and easily became attached to ink rollers. The friable nature of the surface of paper made from esparto was a frequent subject of complaint even after the problem was partially solved by the addition of wood-pulp. The reasons for the change to dry running, which depended no less on pressmen's skill for its successful execution, no doubt varied with each printing house; but dry paper offered two further advantages. It was much less subject to stretch, making accurate registration in the printing press accordingly easier; and there was no longer any need to hang paper up to dry and thus to create a notorious fire hazard.[17]

Paper quality, and the means of printing, dictate illustration. In 1873, photography was a regular part of the manufacture of printed books. The several main processes of reproduction – principally Autotype and Woodburytype – were all employed for illustration. In their different ways, all were capable of work of great detail, as well as great intrinsic beauty. But they shared the same limitation, in that they had to be printed by specialists, on special paper, and then mounted before they could be bound into books. For a while, it seemed that heliotype, a process that was described as being analogous to lithography, but that was printed on an ordinary iron hand press, promised the best and cheapest means, potentially replacing both wood-engraving and lithography. But though it was widely used for a while it was overtaken by other inventions. In this, its closest (and cheaper) rival was photozincography, a method linking lithographic principles to photography and developed in England by Colonel Sir Henry James in the early 1860s. This was at an advantage in that it could be executed on ordinary paper. Both, however, still required a separate printing process, and illustrations printed by these methods were commonly also printed on separate sheets or leaves, to be bound in.[18]

One widespread attempt to reconcile photographic processes with line illustration and letterpress printing lay in the application of wood-engraving techniques

to photography. The photograph was exposed on to a prepared wood block which was then touched up by an artist, enhancing lines as necessary, before the engraver cut the block in the conventional way. In America especially in the early 1870s it was used for news reporting, and it found widespread use in portrait work. In Britain, where it met with considerable opposition amongst wood-engravers, it found most use in the accurate reproductions required of scientific or commercial illustration, and in the reproduction of paintings in magazines or popular books on art.[19]

Long-term change came from two directions. In 1852, W. H. Fox Talbot had taken out a patent designed to permit the printing of a photograph by breaking up the image into a cellular structure. The concept of a ruled screen for the purpose was the subject of another patent taken out by E. J. Bullock in 1865; but it was not until the development of the Meisenbach screen in England in the 1880s and the work of Frederick E. Ives, first in America and then in Britain, that the half-tone block became a practical everyday reality for printers generally. Guided by Ives, the Swan Engraving Company grew to assume a central importance in the British printing industry. Half-tone blocks could be printed letterpress, at the same time and on the same paper as type. Their cheapness of manufacture, and their convenience in printing, ensured their rapid adoption, though the skill required to print them satisfactorily was learned more slowly – largely by trial and error. Presses designed to cope with wood-engravings were unsuitable for half-tones. The super-sized calender paper widely used in the printing trade had too hard a surface, and damaged the blocks, quite apart from giving them a weak appearance: for half-tones, a softer surface was found desirable. Even the temperature in the press room affected results.[20] For line work, the invention of the line block, or zinco as it came to be called, offered the cheapest means of all, and companies such as the Typographic Etching Company quickly displaced the traditional skills of the wood-engraver. The eleventh edition of the *Encyclopaedia Britannica*, published by Cambridge University Press, summed up a generation: 'It has thus come about that the last quarter of the 19th century witnessed the dispossession of the hand engraver from the field of interpretative engraving, and the occupation of his position by the chemist and the mechanician.'[21]

Invention bred competition, and the pages of the *Process Year Book*, founded in 1896, followed by the *Penrose Annual*, became the showground for new processes, especially in colour work. The first three-colour photographic blocks for letterpress printing were made by Ives for the Philadelphia Electrical Exhibition in 1881. In Britain, the lead was assumed by the publishing houses of Cassell and Newnes, both of whom used the process for their mass-market magazines.

Many of these changes took place most obviously not in book printing, but in newspapers and magazines. By the late 1890s, magazines such as the *Strand*, *Pall Mall*, *English Illustrated* and *Pearson's* depended for their success on half-tones. Readers expected to be given entertainment and information in this form. Though in most respects they were a world away from academic publishing and research, in their techniques of illustration they offered the same reading experience. The

technical possibilities in one format raised expectations, and thus assumptions, in others. For much of its illustration in the last years of the nineteenth century and first of the twentieth, Cambridge University Press went – like others – to specialist printers. In Cambridge itself there was Edwin Wilson, whose wood-engravings and lithography were models of their kind, and did much to enhance the reputation of the Press as a scientific publisher and printer.[22] For facsimiles of manuscripts, whether of single pages or (as in the case of the Codex Bezae) for complete books, it went to Paris.[23] London had dozens of firms which could offer different kinds of photographic reproduction, though as a period of experiment settled into one of consolidation their number and variety declined. For much of its work, the Press turned, like many others, to the photo-engraving firm of Emery Walker, originally founded in 1886 in partnership with Walter Boutall.

Even while photography played an increasing role in printing and the appearance of books, magazines, newspapers and advertising alike, there remained a demand for older methods. Many of the books printed at Cambridge for Macmillan in the late nineteenth century bore on their title-pages steel-engravings printed by McQueen, in Tottenham Court Road, a firm which traced its origins back to before 1800.[24] Le Keux's steel-engravings of Cambridge buildings, executed originally in the 1840s and periodically used again since, were still employed for the Press in the 1880s.[25]

As the number of available printers and reproductive processes increased, so questions of how books should be printed became more complicated.[26] Ever since the fifteenth century, letterpress and intaglio printing had evolved separately, usually in the hands of different workshops or businesses. In the early nineteenth century, lithographic printers established themselves likewise independently, to take in specialist work. Few printing firms were large enough to offer the diversity of skills and equipment necessary for processes that were fundamentally different. For ordinary letterpress, quite apart from printing from copper plates, shared printing had been commonplace since the sixteenth century. By the late nineteenth century, the several methods of reproduction of illustrations, often involving considerable expense in equipment as well as different skills, greatly encouraged not just local, or even national, collaboration. Shared printing was international, and not only for pictures or other visual matter. It was also a feature of printing in oriental languages, when suitable type was not locally available. Other specialist work, such as music printing (whether letterpress or intaglio) had also sometimes to be sought from elsewhere. Even ordinary letterpress was not infrequently set in other houses, and delivered for machining in the form of stereo plates.[27] The apparently simple statement, that customarily (and by law) appeared on books, 'Cambridge: printed . . . at the University Press', in fact might conceal much of their manufacturing history. It was a statement of legal responsibility, not necessarily accurate in a bibliographical or manufacturing sense.[28]

For Cambridge, as for almost all publishers and printers, the application of lithography to book printing both offered new possibilities and posed new challenges. Even though they might be practised within the same firm, letterpress printing and

lithography were quite separate skills, their distinctiveness reflected in trade union organisation and in more personal loyalties. This affected ways of thought at every level. By the late 1920s, lithographic offset printing was widely available. Cambridge University Press chose to work with Lund Humphries, printers in Bradford, but it was to be several years before inks of sufficient colour strength had been developed to avoid the grey effect of most offset printing, and the slight spread of ink also associated with it.[29] Nonetheless, for reprints of books lithography offered a valuable alternative to the expense of keeping type standing, or to making stereo or electro plates that were themselves subject to wear. For its part, the Printing House at Cambridge remained wholly committed to letterpress until the 1960s.[30]

In 1873, all type at the Pitt Press was set by hand. The experimental typesetting machines developed in the previous two decades never found a place in printing at Cambridge. Even in the early 1970s, some type was still hand-set, especially in mathematics, display or other specialist work.

This was the century of hot-metal composition. The installation of the first Linotype machine in the *New York Tribune* in 1886 marks the beginning of a period dominated by hot metal.[31] Already in 1887 Talbot Baines Reed, managing director of one of the most important of the London type-founding firms, was predicting an end to type-founding as it had been known for centuries. 'Letter Founding today bids fair to break all her old ties and take new departures undreamed of by those heroes of the punch and matrix and mould who made her what we found her.' In that year *The Tribune book of open-air sports* was published in New York, the first book to be set by Mergenthaler's Linotype machine. The age of progress in which (in Reed's own words) he found himself caused Reed not only to compile a remarkable and authoritative history of British type-founding, and so in some measure redress the losses inevitable when (in his words again) the fine arts were rapidly becoming trades, but also to to look forward: to 'encourage the study of our national Typography, with a view to profit by the history of the past in an endeavour to promote its excellence in the future'.[32]

By 1899, Linotype was showing a profit of over £200,000.[33] Much advertised in the trade press, it found its heaviest use in newspaper printing and in mass-market paperback work. In 1890 a factory was opened near Manchester, and by 1901 the same firm was also building presses – including the widely popular Miehle and Century machines.[34] Such diversification was prudent, for the future of typesetting was far from clear save in one respect: that cheap type and rapid typesetting would be the keys both to production and also to labour costs. Meanwhile, the Wicks typecasting machine, linked to a Kastenbein composing machine, did daily service at *The Times*.[35] In 1900, the Monoline machine, from Canada, received a *grand prix* at the Paris exhibition.[36] Neither prospered, but they were no less part of the search for speed and economy.

In 1887, patents were granted in America to Tolbert Lanston for the development of a machine that instead of casting lines as solid slugs, like the Linotype, would instead set them from individual pieces of type, cast as they were required.[37] The

new competitor, Monotype, eventually dominated the British book-printing market for much of the twentieth century; but though one of Lanston's early machines was given front-page treatment by the *British & Colonial Printer & Stationer* in 1892, the Monotype machine was not a familiar sight in British printing offices until the early twentieth century. By then it had been considerably changed and improved. In 1897, the Lanston Monotype Corporation Ltd was established in Britain. By the end of the year two machines were at work in Wyman & Sons in Fetter Lane, and in 1900 the firm's machinery was also installed at Cassell's printing works in London.[38] By the end of that year there were twenty-two machines at work in Britain.[39] Unlike other systems, it depended on two quite separate elements. The operator at the keyboard produced, by means of compressed air, a perforated paper spool that was in turn fed into the much heavier (and noisier) caster. Although, like most innovations, it became established and accepted in some ways only gradually, this process of integration was in fact achieved with remarkable speed. Interest in such developments was by no means confined to cliques in the printing trades. In 1897 G. W. Steevens wrote almost lyrically of Monotype in W. E. Henley's *New Review*, his article appearing with the latest instalment of Conrad's *Nigger of the 'Narcissus'*.

> It is so complete and provident, foreseeing every difficulty and surmounting it, aware of every advantage and seizing it, that you can hardly help feeling it to be a portent, inexplicable, born out of season, without father or mother, or beginning of days.
>
> Click, click, click . . .
>
> It is the most human of all machines, and the most inhuman. It is human in its seemingly self-suggested intelligence, inhuman in its deliberate yet unresting precision.[40]

To Steevens, and no doubt to others, it offered the possibility of every author becoming his own printer. He was but one among several journalists enticed to the machine installed for test purposes in Leadenhall Street in June 1897. Others were more factual; but though the writer in the *Daily Mail* called it 'the most appalling machine in the whole range of demonology' all were impressed.[41]

The trade's most substantial arbiter, *Penrose's Pictorial Annual*, followed by printers, their suppliers and by interested non-specialists as an authoritative guide to technical innovations, was set by Monotype in 1904. The editor was unequivocal, describing the machine as 'the greatest mechanical boon ever presented to the printer. It is rapidly changing the whole life and aspect of our printing offfices, and undoubtedly it is a machine which must immensely influence the future of letterpress printing.'[42] For once, a prophet was proved right. When in 1908 the Monotype 'D' keyboard was introduced, with its standard typewriter layout, touch control and much simplified valve design, printers found themselves provided with a system of great delicacy whose engineering was universally admired. From its offices in Fetter Lane (just to the north of Fleet Street), and its works near Redhill, Surrey, Monotype supplied printers across the country. Cambridge University Press installed its first Monotype machine rather late, and in response to competition, in 1913.[43]

Although Monotype came to dominate the book-printing market in Britain, the early years were not straightforward, and even latterly it only succeeded thanks to a rare combination of engineering genius and careful pricing with constant and imaginative publicity. The existing composing trades greeted it with what proved in some quarters to be justifiable wariness, the more so when women were employed as keyboard operators: the complete separation of keyboard and caster readily lent itself to physical as well as organisational segregation between the sexes. In Edinburgh, where the largest book printers had employed women compositors since the 1870s, there was a women's section of the Scottish Typographical Association by 1912. The consequent threat to men's employment, and the savings that could be made in production, formed the background to bitter arguments in the Scottish printing industry, both between masters and men and between firms in Edinburgh and Glasgow.[44] But in most towns the new demands of the Monotype were learned by men; and by the time that Monotype equipment was installed at Cambridge it had been agreed in Edinburgh to engage no more women for such work.

Monotype setting depended on two complementary but quite different skills, at the keyboard and at the caster. It was some years before employers recognised their equal importance for efficient operation, and the company found itself obliged to support a large staff of technicians able to be called in at short notice for even quite minor difficulties.[45] By this means, as well as by encouraging close liaison for the supply of fresh matrices, it cultivated customer loyalty, with results that for Cambridge University Press were of fundamental importance for the development of both Monotype and the Press.

When Reed wrote his study of the history of British type-founders, the printer had available to him an array of faces from dozens of manufacturers on a scale greater not only than ever before but also probably than anywhere else in the world. By 1900 the trade directory listed forty-four founders in London alone.[46] But much of what was available was of poor quality; there was much duplication or near duplication; and there was little understanding of how type design influenced reading. Perhaps most of all, there was little appreciation of how an excess of typefaces used too close to each other could actually distort and obscure meaning. Typographical eclecticism in advertisement setting could, if used properly, draw attention to particular themes. In most book printing author and reader benefited from a typographical environment that was more restrained.

In many respects, the following fifty years were a process of recovery of the strengths of the past by means of modern technology. The first hundred or so of the earliest typefaces made available on Monotype reflected, not surprisingly, those that were available from ordinary founders. But series 101 (Imprint), issued in 1912, marked a break – not only in design but also in concept. It was developed to meet the requirements of high-speed presses designed to give a 'kiss' impression; and it broke away from the concept followed hitherto: that types for machine-setting should echo as faithfully as possible what was available in founders' type. Monotype Imprint, derived partly from Caslon, and designed at least in part by J. H. Mason,