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# Monotype and phototypesetting



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## PHOTOTYPESETTING ‘GENERATIONS’

Early phototypesetting systems are often categorized as first or second generation devices, and later machines as third and fourth generation. There are, however, few hard and fast rules about exactly what characterizes systems in each category.

As John Seybold states in his book *The world of digital typesetting*<sup>1</sup> the concept of applying generations to phototypesetters was probably borrowed from the computer industry. Since Seybold is one of the clearest exponents on the differences between the generations, and since most writers in the field would probably defer to Seybold in this matter, I'd like to summarize what he regards as fundamental to each generation:

The defining feature of *first* generation machines is that they ‘... were adapted from hot metal models (or impact typewriters) and worked as nearly as possible on the same principles’. We think of first generation machines as those incorporating photographic character images which were held stationary at the point of exposure, with a light source which passed through the required character only, and which were based on mechanics rather than electronics.

It's generally held that *second* generation machines either used a stroboscopic light which flashed through a constantly moving disc of photographic character images, or contained a light source which flashed light through more than one photographic character image on a stationary grid and additionally utilized a moving shutter to cover the character images which were not required. The defining feature according to John Seybold, however, is that ‘... a second-generation machine was one which was especially conceived and designed to set type by photomechanical means.’ Loosely, we also consider at least simple electronics as fundamental to second-generation machines.

Seybold defines *third*-generation machines as those which do not expose type directly from photographic masters at all, but which reproduces them electronically on the face of a cathode-ray-tube. Loosely we have a notion that third generation machines either scan a photographic master inside the system, or they do not contain an

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I am also grateful to Lawrence Wallis for his invaluable assistance, comments, thoughts, and for the loan of his files from which many of the illustrations originate. Phil Baines, Robin Nicholas, and David Saunders read a draft of this article and provided valuable comments.

This work is dedicated to the memory of my sister, Susan, who died whilst it was in preparation.

1. John W. Seybold, *The world of digital typesetting* (Seybold Publications, 1984), p. 112.

analogue character representation at all, but instead store pre-digitized renditions on magnetic disc or in computer memory. In addition we think of third generation machines as capable of writing character images only, and of writing character-by-character, or area-by-area across the output substrate (film, photographic paper, etc.).

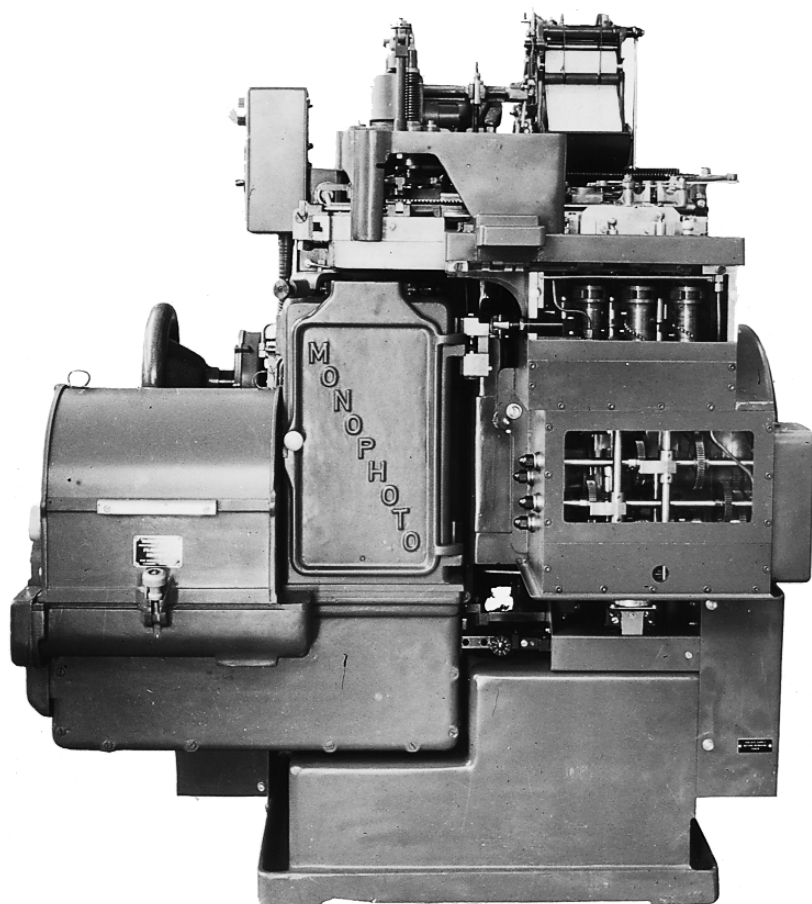
Seybold doesn't actually define the '*fourth-generation*' but he does apply the category to certain machines. I suspect some might say that machines which store pre-digitized renditions of characters constitute fourth generation machines, but my understanding of Seybold's thinking is that he would consider fourth generation machines as those which go a step further and are capable of outputting text and graphics together by rendering whole pages built up line by line – utilizing a raster image processor to instruct a laser beam coupled to a deflection mechanism of some kind.

Generational classification of this kind is useful because it defines a flow of development and increasing sophistication which is not mirrored by a chronological analysis. All Monotype's phototypesetting systems released between around 1955 and 1968, for example, can only be considered first generation machines, since their mechanisms were directly based on the Monotype hot-metal composition system. But the machine which we would regard as the earliest second-generation system – the Higonet-Moyroud machine – had its first trial installation (when it was first called the Photon 100) at the *Patriot Ledger* newspaper in Quincy Massachusetts in 1954: three years before the first Monophoto installation took place.

#### MONOTYPE PHOTOTYPESETTING MACHINES AND THEIR 'GENERATIONS'

Experiments with photocomposition began at Monotype in the 1930s. George Westover, Monotype's London Manager, filed patents in 1936 for his Rotofoto system of phototypesetting.

Westover and his colleagues clearly saw that there was some kind of future in the setting of type photographically and the application of lithography to the printing of text. Westover's Rotofoto was demonstrated in 1948, and soon after this a system was installed at the London School of Printing. But E. Silcock, General Manager at Monotype's 'Works' in Salfords at the time, had earlier decided not to proceed with the product and Westover had left the company due to a proposed scheme of salary cuts. Monotype refused to show any interest in the system, and gave Westover no financial support.



1 Monophoto Mark 2

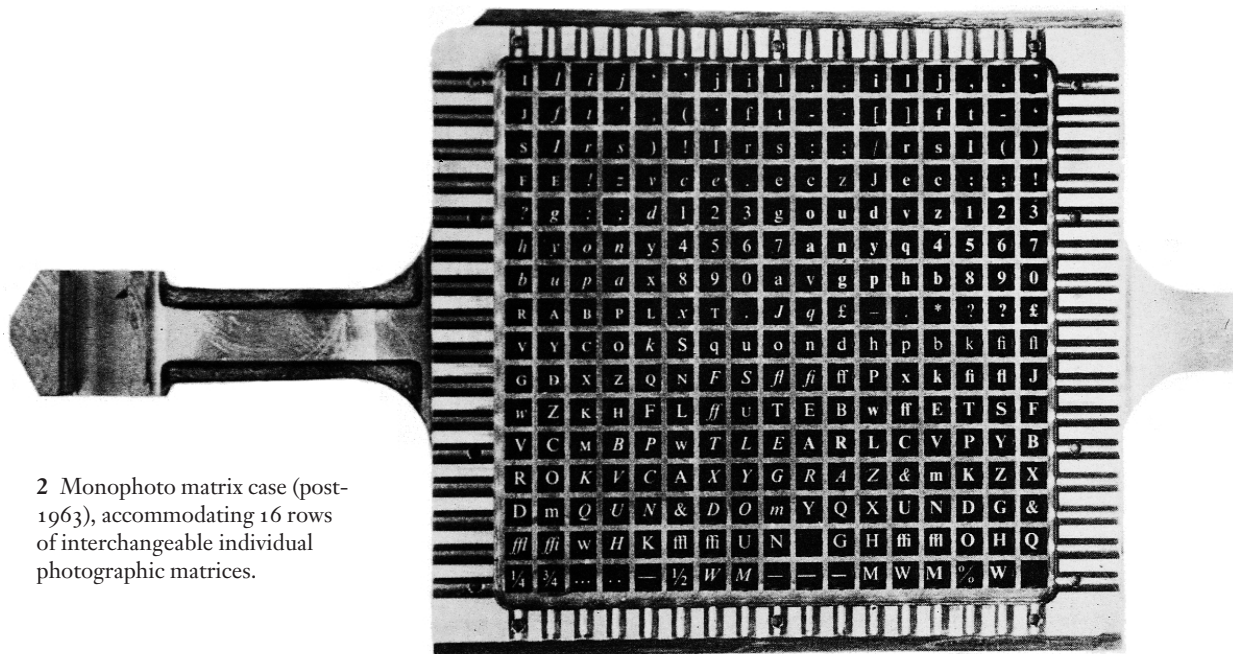
### *Monophoto Mark 1*

The earliest Monophoto phototypesetting system was *not* a development of the Rotofoto, but it is thought that its development did contravene some of Westover's patents.<sup>2</sup> Ironically, it was announced in an article ascribed to E. Silcock in the 1952 edition of *The Penrose Annual*. Later known as the Monophoto Mark 1, this machine stored seven alphabets of photographic character images on one master photo-matrix plate. It resembled, in all essential details, the Monotype hot-metal caster, and the separate Monotype keyboard was also essentially identical to that used with the hot-metal caster. Silcock claimed it was capable of speeds of over 200 characters per minute (i.e. three and a third characters per second), and it could set type in sizes from 4.5 to 24 point, but this machine did not make it into a commercial installation.

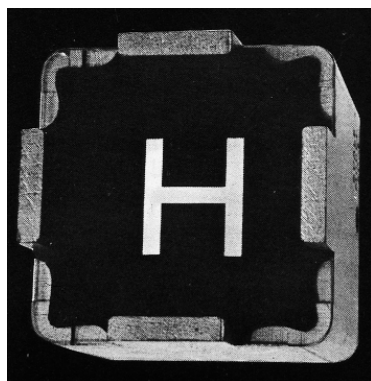
2. Lawrence W. Wallis, *Typomania* (Upton-upon-Severn: Severnside Printers Ltd, 1993), p. 18.

*Monophoto Mark 2 to Mark 5*

All subsequent adaptations of the Monophoto Mark 1 – the Mark 2 of 1957 to the Mark 5 of 1969 – simply saw gradual improvements to the same basic functionality: though what allowed the Mark 2 success in the market place was the incorporation of a matrix case of interchangeable individual photographic matrices – similar in construction to the hot-metal caster’s matrix case – in place of the Mark 1’s single master photo-matrix plate.

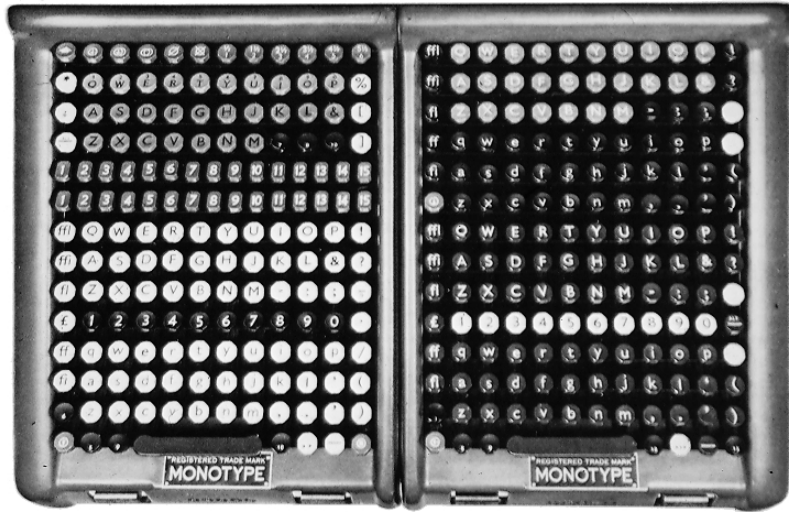


2 Monophoto matrix case (post-1963), accommodating 16 rows of interchangeable individual photographic matrices.



3 An individual Monophoto film matrix

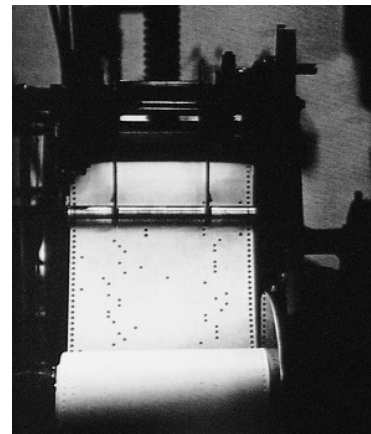
The similarity of the Mark 2 to 5’s matrix case to the hot-metal caster’s matrix case further identifies these machines as first generation systems. In early machines the case accommodated 15 rows of 17 matrices, and from 1963 on it contained 16 rows of 17 matrices, making a total of 272 available characters. (The original hot-metal system used a matrix case of 15 × 15 characters and spaces.) Each matrix measured 0.2 of an inch square. At this time of course there was concern about the sizing of characters photographically in phototypesetting systems. Monotype adapted its hot-metal approach to font masters to this technology by making available A, B, and C photographic matrices: each set being designed for typesetting a specific range of typesizes. (In practice, however, most customers just set all sizes from the B matrices.)



4 Early Model D Monophoto keyboard

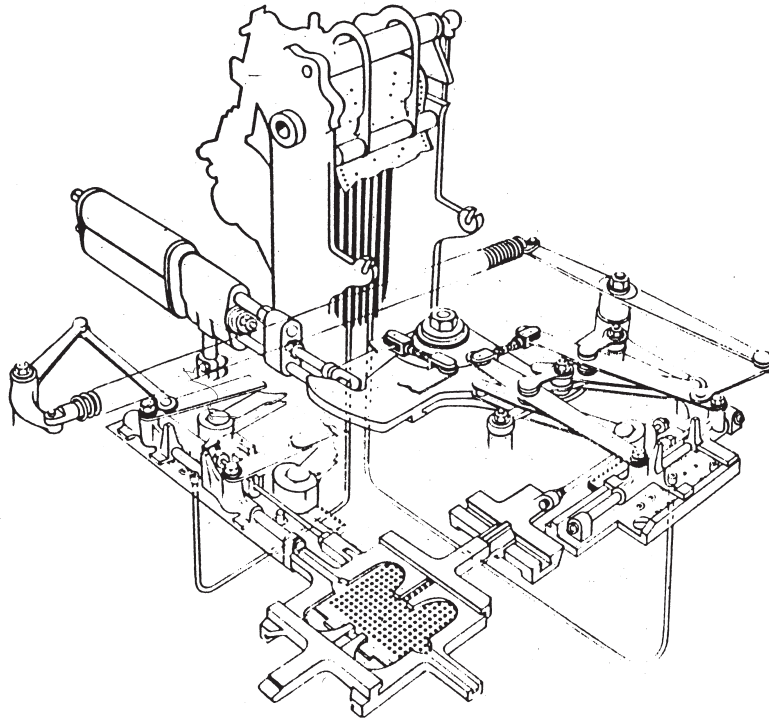
There were further similarities between these machines and Monotype's hot-metal caster and keyboard:

- The keyboard comprised two banks of 168 keys, each in a 14 by 12 arrangement, making a total of 336 keys. All characters in the matrix case were therefore accessible from one key: and all seven alphabets could, in the standard keyboard arrangement, be accommodated – the seven alphabets being roman, italic and bold capitals, roman, italic and bold lowercase, and small capitals. The Model D keyboard was used in Monophoto Mark 2 and Mark 3 installations. The later Model E keyboard allowed for the increase in the capacity of the matrix case on the release of the Monophoto Mark 4.
- The keyboard produced 31-channel paper tape which provided the coordinates for the selection of characters in the matrix case. This precisely followed the paper-tape principle in the hot-metal caster.
- The separate filmsetting unit contained a matrix-case-positioning-mechanism which was almost identical to the metal caster. In the caster the coordinates from the paper spool were read pneumatically to control pins so that the appropriate matrix selected by the coordinates was brought into position over the mould. In the filmsetting unit the same positioning mechanism brought the film matrix case into position under a lamp and condensing lens, and above a shutter.
- In addition all five releases of the Monophoto machine slavishly adopted the basic mechanical principles of the metal keyboard

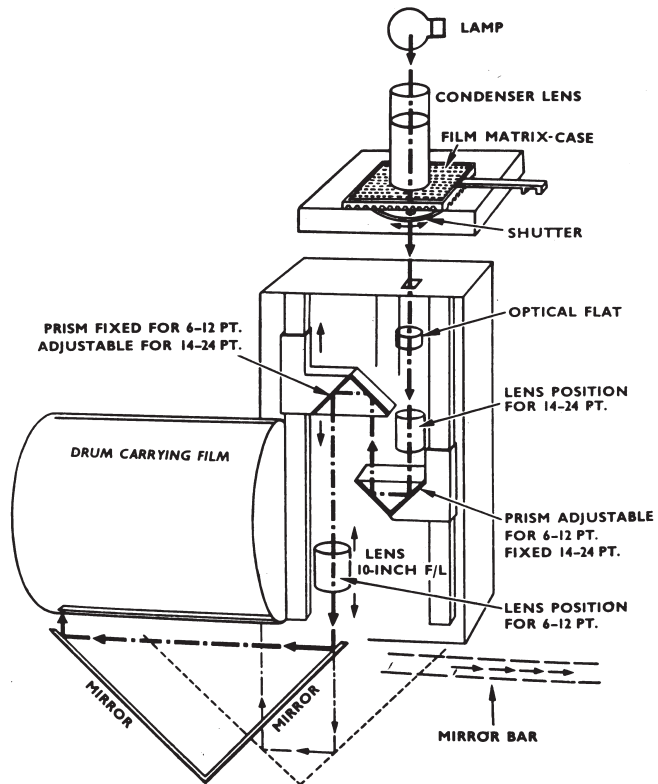


5 Monotype 31-channel paper tape

6 Matrix-case positioning mechanism on the Monotype caster



7 Optical path of the Monophoto filmsetting unit



and caster: Monotype seemed uneasy with electronics, and the continued dependence on 31-channel tape shows that they were also uneasy about the application of computers to typesetting (though they had in 1965 developed a paper-tape conversion machine to convert computer-output 5, 6, 7, or 8-channel tape into 31-channel tape for Monotype or Monophoto output). (There were two other methods for driving Monophoto Mark 2 to 5 filmsetters from computer output: these were Rocappi's 6-channel tape reader which activated solenoids to simulate the effect of a 31-channel tape passing over the reader, which provided the compressed air drives for the positioning of the matrix case; and Guttinger Satz Automation of Switzerland who developed their own computer system which output 31-channel Monotype paper tape.)<sup>3</sup>

The first installation of a Monophoto Mark 2 filmsetter took place in 1957 in South Africa, and the same year saw an installation in Brussels and four machines shipped to the United States where they were installed at Westcott & Thomson (Philadelphia), Logan Square Typographers (Chicago), and a Government Agency in Washington.<sup>4</sup> The first commercial installation of the Mark 2 in Europe was at Photoprint Plates Ltd of Basildon in Essex in February 1958.

The Mark 2 output at a speed of around three c.p.s., in sizes from 6 to 24 point, with 272 characters available: and soon after release a Mark 2 filmsetter plus keyboard cost around £12,000.

In 1963 six new facilities were added to the Mark 2 and first exhibited at IPEX. These were:

- A new method of signalling 'character delete'
- A single-unit spacing facility: especially useful for the setting of mathematics, but also useful for general letterspacing
- Character kill: a facility which took precedence over all other perforations in a line
- Double exposure: allowing the exposure of more than one image in the same position, thus allowing economical setting of fractions, patterns, etc.
- A quadder: allowing the high speed keyboarding of leaders, rules, and space
- A low-alignment function: designed to facilitate efficient keyboarding of superiors and inferiors in mathematics.

3. *The Seybold Report on Publishing Systems*, Vol. 2, No 18, 28 May 1973, p. 5.

4. *The Seybold Report on Publishing Systems*, Vol. 2, No 18, 28 May 1973, p. 3.

The Mark 3 was introduced at TPG in Paris in 1965. It boasted an increased running speed and improved justification techniques.

It was not until the release of the Mark 4 in 1967 that the matrix case was increased to 340 characters and spaces (17 rows of 20 matrices). The Mark 5 released in 1969 allowed for the setting of more complex texts – including chemical formulae for example – and increased leading capabilities ranging from 0.5 to 31.5 point in half point increments.

The size range of the Mark 5 was identical to the Mark 2: between 6 and 24 point. It had 68 more characters available in its matrix case, but its top running speed was only 1 character per second more: achieving four c.p.s. These machines therefore ran at about the same speed as a Monotype hot-metal caster.

In total Monotype sold around 550 Monophotos (Mark 2 through Mark 5), of which around 20 were installed in the USA. In the UK 94 machines were installed at 52 locations. The rest were at installations throughout the world.<sup>5</sup>

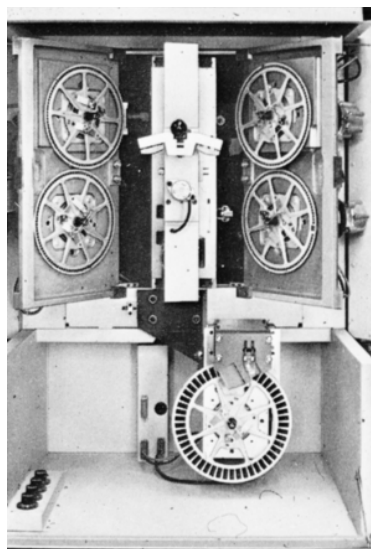
### *Monophoto 600*

In the same year that the Mark 5 was released – 1969 – Monotype showed the Monophoto 600 in Milan (though the first installation – in Brussels – did not take place until 1971). At long last this was a machine which depended on electronics instead of mechanics, and it was designed to run from computer-output 8-channel paper tape. (The system was also later marketed under the brand name ‘Monotype System 2000’.)

This system stored photo matrices on four oscillating – but not constantly revolving – discs, each holding 100 characters, along with up to 200 additional characters as 35 mm slides in a carousel slide magazine. (The slide carousel could be replaced by a fifth disc). The matrix images were identical in size to those on the earlier Mark 1 to 5 systems.

Users could make their own slides, and were issued with instructions about how to do this using a Monotype Studio Lettering machine. This machine, designed to complement Monophoto film-setters, allowed the manual production of display lines of type in sizes from 6 to 125 mm, and resembled a photographic enlarger. Monotype’s first ‘Photolettering Machine’ had been released 6 years earlier, in 1963 and the Photolettering Machine Mark 2 was also released in 1969.

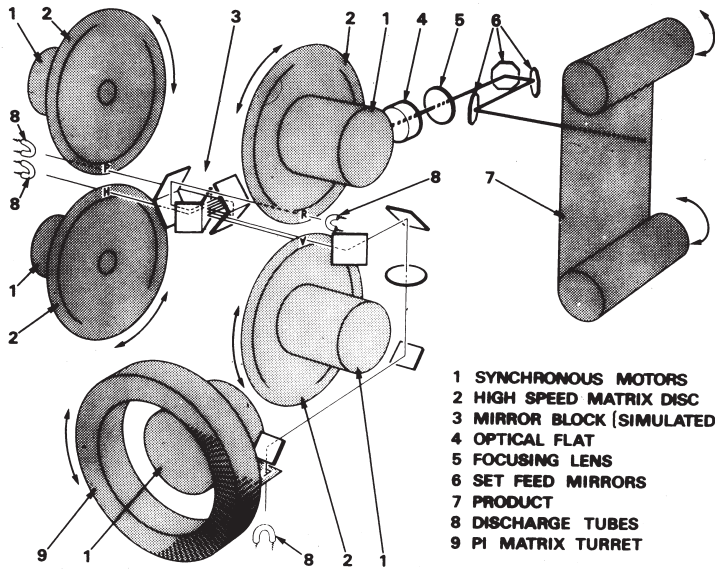
The Monophoto 600 had four light sources – one behind each disc. The light source for the fourth disc was also utilized to illuminate the pi slides (or fifth disc).



8 The four discs and pi carousel of the Monophoto 600

5. *The Seybold Report on Publishing Systems*, Vol. 2, No 18, 28 May 1973, p.4.





9 Optical system of the Monophoto 600

Though it produced 8-channel computer tape, and though now controlled by electronics, the keyboard could still not be mistaken for any system other than a Monotype. It housed two familiar banks each with 17 rows, with 13 keys in most rows, making a total of 221 keys. It was operated in association with a separate logic unit – which provided the calculations and controls for the operator to make end-of-line decisions. The tape output unit sat on top of this. The system could be supplemented with a tape-merging unit – a feature which had long been available in other manufacturer's systems – which allowed original and correction tapes to be merged to produce one corrected tape. This reduced correction time and laborious stripping of corrections, and it allowed the insertion of running heads and folios to facilitate output of cast-off galleys.

In its most flexible mode users would have different complete fonts on each disc: e.g. Times Roman on one disc, italic on another, etc. But this meant longer disc travelling in standard operation, and so resulted in slowest output speeds. By spreading fonts across the discs users increased speed but had to accept a resulting loss in font flexibility. As a result output speeds of this machine varied from 16 to 27 c.p.s. (It was therefore between four and seven times faster than the Mark 2 to 5 machines.) Its speed, of course, would always be limited by the fact that the discs were stationary for exposure (though it's worth noting that this was driven by Monotype's view that high image quality depended on the stationary matrix). It had 600 characters available (260 more than the Mark 4 and 5), and, in its basic configuration, could set eight lens-fixed sizes from 6 to 14

point. (The same lens settings when used with discs of large-composition matrices allowed the machine to set sizes from 16 to 28 point, but the machine's size range was effectively more limited than the Mark 2 to 5 machines.)

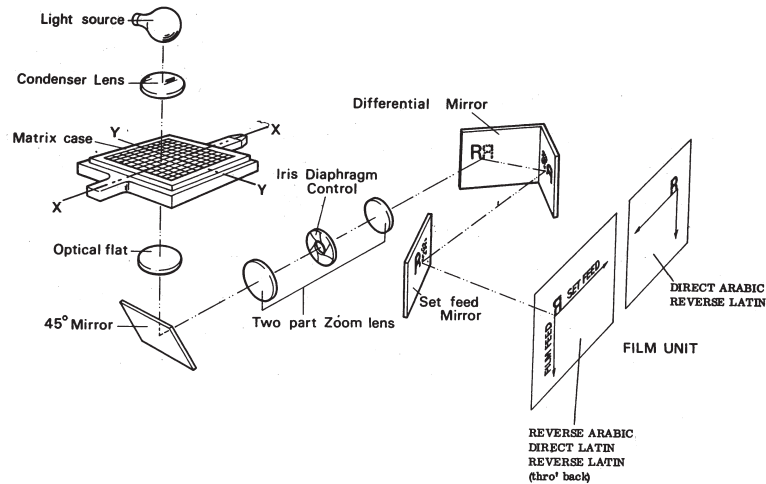
Lawrence Wallis described the machine as 'abstrusely eccentric', and noted that the machine was '...a peculiar and over-elaborate design fraught with technical complexity and capriciousness in operation'.<sup>6</sup>

*Monophoto 400/31 and Monophoto 400/8*

Monotype's next offerings, the 400/31 released in 1973 and the 400/8 released in 1974 (also branded as 'System 1000') reverted to the use of the traditionally-styled Monotype matrix case: but here enhanced to 20 rows of 20 matrices (hence the '400' designation).

The matrix case moved back and forth under pneumatic control, much as with the Mark 2 to 5 machines. The major difference between the 400/31 and the 400/8 was, of course, that the first used exclusively 31-channel Monotype paper tape, and the second utilized 8-channel computer tape.

10 Optical path in the Monophoto 400



On its release in 1969 a Monophoto 600 filmsetting unit alone had cost £28,000, and a full system with keyboard, tape perforator, and tape merging unit would have cost £43,000.

The Monophoto 400/31 on its release cost a mere £10,000, and a full system cost around £17,000. A 400/8 system cost around £18,000. It was therefore much less expensive than the Monophoto 600, but also rather less flexible. However, the 400 was still expensive when compared to certain machines available from other manufacturers by this time.

6. Lawrence W. Wallis, 'Monotype: the long slippery slope', *PHS Bulletin*, 33, pp. 1-6.

The 400/31 utilized the familiar pneumatic two-bank Monotype-style keyboard or a Monotype tape perforator. The 400/8, being essentially a computerized version of the same machine, incorporated an 8k computer. As the output device read 8-channel tape, keyboarding could be carried out on a number of different perforator keyboard units, from a typewriter-styled device to a micro-computer with visual display terminal: though, of course, Monotype also allowed the option of input via a 434-key, two bank, keyboard.

The optical characteristics of both Monophoto 400 machines were not dissimilar to the Mark 2 to 5 machines, and by using the traditional shutter system plus matrix case – again held stationary for exposure – these machines were only capable of maximum speeds of 11 c.p.s. (slower than the 600 when it was running at its slowest). The matrix case of 400 characters, though more flexible than the Mark 2 to 5 systems, was only two-thirds the capacity of the Monophoto 600. The size range of both these machines was 5 to 24 point (only one size greater than the Mark 2 to 5 machines which had output 6 to 24 point).

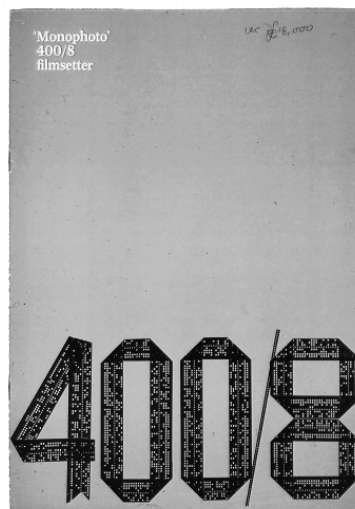
Generational classification of the Monophoto 600 and the two 400 machines is not straightforward. The fact that they were electronic devices, I think, leads John Seybold to classify these machines as second-generation.<sup>7</sup>

Although the 600 utilized a matrix storage and selection system which was clearly not an adaptation of the predecessor hot-metal machine, it nevertheless maintained the stationary matrix concept which is more first-generation in approach than second. Also, though the system was electronic, and though it accepted 8-channel computer tape, the 221-key pneumatic keyboard again is more suggestive of first-generation than second.

Exactly the same could be said of the two Monophoto 400 systems, and here the matrix storage and selection system conforms again to the adapted hot metal system, so these more recent machines might be said to be even more suggestive of first generation technology than second.

The only second-generation characteristics that these machines display are:

- the use of electronics in all cases
- the use of 8-channel paper tape in the 600 and 400/8
- in the 400/8 the application of a computer and the option to input via a computer-style keyboard
- in the 600 the storage and selection of characters from oscillating discs as opposed to the traditional matrix case.



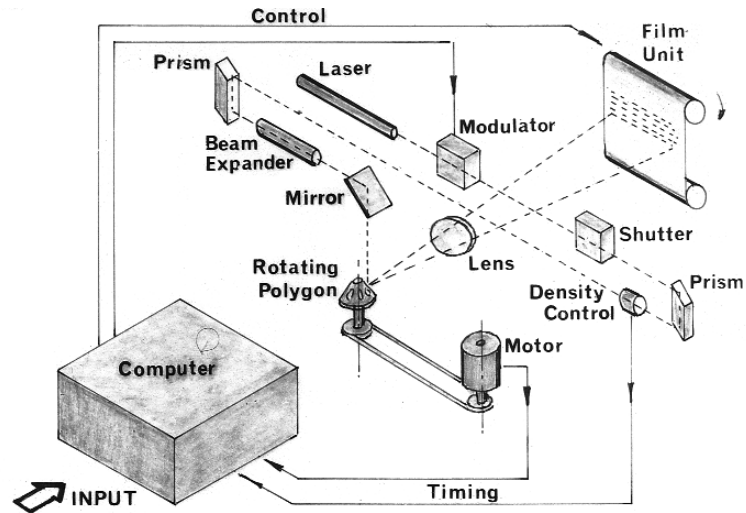
11 Brochure for Monotype 400/8 Filmsetter. The number is composed of 8-channel paper tape.

7. John W. Seybold, *The world of digital typesetting* (Seybold Publications, 1984), p. 386.

*Lasercomp*

In 1976, only two years after the release of the Monophoto 400/8, Monotype revealed the Lasercomp in June at the American Newspaper Publishing Association Research Institute Meeting and Exhibition in Las Vegas.

The Lasercomp was a digital laser typesetter, of the kind we would nowadays have no problem in calling an imagesetter. It used pre-digitized renditions of characters stored on disc; and it was capable of outputting complete pages incorporating both text and graphics, by utilizing a raster image processor to feed instructions to a rotating polygonal mirror which directed a high-resolution internal laser beam on and off the output substrate.



12 Optical path of the Lasercomp

Though many industry experts acknowledged the excellence of the Lasercomp, its revolutionary nature is often under-stated. My description clearly defines it as a down-the-line fourth-generation device. Indeed, Andrew Tribute in *The Seybold Report on Publishing Systems* identifies the Lasercomp as the first fourth-generation typesetter. He notes that it was not the first laser typesetter, but it was the first raster imaging typesetter, and the first commercially successful laser typesetter in the market.<sup>8</sup> He also notes that ‘... cynics within the Company joked that because Monotype took so long to develop and refine any product, it decided to move from the second generation to the fourth generation, skipping the third-generation CRT typesetters, to at least ensure that its product got there first.’<sup>9</sup> (Most other manufacturers continued to market third-generation devices

8. Andrew Tribute, ‘Monotype: from a distinguished past, boldly facing the future’, *The Seybold Report on Publishing Systems*, vol. 18, no. 18, 1989, pp. 4–8.

9. Tribute, ‘Monotype: from a distinguished past ...’, p. 4.

incorporating CRTs, and failed to recognize the shift towards imaging of text with graphics and the development of interactive integrated imaging and input terminals. Consequently Monotype had this market to itself for almost ten years. Again it is worth noting that Monotype's rejection of the CRT was probably down to the quality and density of the exposed character image.)

The first Lasercomp output a maximum page width of 58 picas, and this was soon followed by a 100 pica machine. By any sort of comparison to any of Monotype's previous systems the Lasercomp was fast. A significant initial speed drawback was that because the system had to sweep the entire width of the exposure window it took as long to expose a single-column galley of 11 picas as it did to expose the full 58-pica page (and competitors sold their machines against the Lasercomp by arguing that it was not a machine for galley output). It was therefore only after some years that the system really came into its own as the machine's graphic capabilities were improved (especially in 1980/81) and as more functional front-end systems with preview and pagination facilities became available. Because of the revolutionary output method, speed figures for purposes of comparison to earlier systems are difficult to calculate, but one quoted example was 1100 newspaper lines of 11 pica width per minute, which roughly equates to 550 characters per second (henceforth c.p.s.). It could output in sizes from 4 to 256 point (or Didot), and it could output any requested size in quarter point increments. The Monotype sales slogan was 'a page a minute with everything in it'. There were 128 characters in each font, and its basic font capacity was 140. Certainly between 1974 and 1976 Monotype had made a giant leap: the core development work on the Lasercomp was carried out by Monotype's David Hedgeland.

The succession of Lasercomp machines up to 1985 ran as follows:

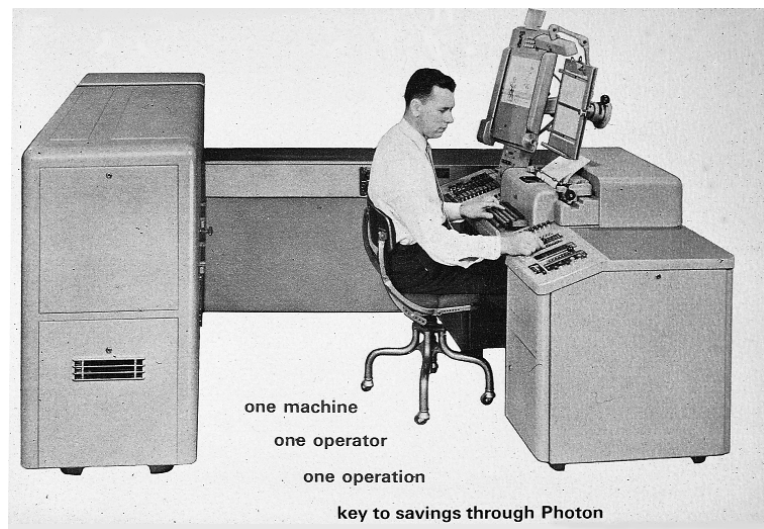
- Lasercomp Mark I 1976
- Mark II 1981
- Mark III 1982
- Lasercomp Sprint 1983
- Lasercomp Sprint Mark II/70 1984
- (Graphics terminal was introduced in 1984)
- Blaser 1985
- Pioneer 1986.

DISCUSSION

I have outlined Monotype's phototypesetting machine developments from the Mark 1 announced in 1952 to the Lasercomp released in 1976. I now need to briefly describe some other key developments of competitors from the period which provide the context for my further discussion about why Monotype followed their course of development.

When Monotype installed its first filmsetters a number of competitor companies were manufacturing their own systems whose designs were similarly based on forerunning hot-metal systems: the Intertype Fotosetter would be a good example.

13 Photon 100 publicity material



However, as I mentioned above, the earliest second-generation phototypesetting system, the Photon 100, had been installed three years earlier. The Photon was an electronic system (as opposed to first-generation mechanics): in 1956 early production models were called Photon 200, and by the time Crosfield Electronics took on the marketing of the machine in the UK in 1961 the machine had reached the development designation of 'Photon 540'. It consisted of a keyboard unit which produced 8-channel computer tape. The paper tape instructed a control unit which sent instructions to a slave phototypesetting unit.

The slave unit incorporated a constantly revolving photodisc which held 1440 character images (16 fonts of 90 characters each), and depended on stroboscopic principles to flash a light through the disc as the appropriate character passed before it. As a result the phototypesetting unit was capable of outputting up to around 10

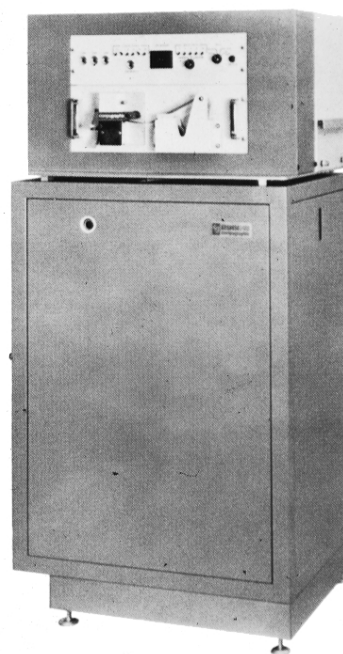
c.p.s: three times the speed of a Monophoto filmsetter. Its lens turret allowed setting in a selection of sizes from 4 to 72 point.

The first third-generation device to be conceived was first shown at DRUPA in 1967. Peter Purdy and Ronald McIntosh showed the PM Filmsetter 1001 which they had started developing in 1963. Their work was supported by K. S. Paul Ltd, and the same year saw that company's merger with Linotype: hence their machine was brought to market as the Linotron 505. It held 1016 characters on four glass grids, each holding 238 character images, plus a pi plaque of 64 characters. The device incorporated an index, or scanning, cathode ray tube which scanned characters on the grids. Output was via a second printout CRT. At it's fastest (i.e. lowest resolution and minimal grid changes) the machine output 160 twelve-pica lines per minute: roughly equivalent to 80 c.p.s. It set sizes from 4 to 28 point with an additional four-times option allowing sizes up to 72 point.

Also in 1967, Hell's Digiset, was first installed in Germany. Announced in 1965, this machine was the first phototypesetter not to contain analogue character images at all, but to contain pre-digitized font renditions. This development was ultimately fundamental to fourth-generation machines, but its method of operation and lack of graphic capabilities mean that the machine could only be classified as third generation.

As far as my analysis of Monotype's course of action is concerned, perhaps a more significant landmark around this time was Compugraphic Corporation's entry into the phototypesetting market in 1968. This is not because of any particularly landmark technical development, but because of Compugraphic's incredibly low prices. The CG2961, for example, was capable of outputting only two type styles in a limited range of sizes, but with an average output speed of 15 c.p.s. I have already noted that on it's release in 1969 a Monophoto 600 filmsetting unit alone cost £28,000: the CG2961 hit the streets at a mere £4950. (I appreciate that device-cost alone provides no satisfactory comparison, and I'll be providing more relevant price comparisons below. This cost comparison is, however, radical enough to have some immediate direct meaning.) Compugraphic made money by selling a lot of units, and the CG2961 had a big effect on the sales of competitors like Monotype and Photon.

I can not cover *all* the reasons why Monotype followed their course of photosetting development. The reasons are complex and heavily bound up in company economics and politics. Firstly, I'd like to propose that Monotype's phototypesetting evolution is punctuated by three critical developments, each of which was influenced by other developments in the industry. Secondly I'd like to discuss the



14 Compugraphic CG2961 of 1968

key arguments Monotype used to convince customers and potential customers to adopt Monophoto systems: these provide an insight into why Monotype developed machines in the way it did.

*Three critical developments*

The first of the critical developments was the adoption of individual photographic matrices in the Mark 2. Allowing users the flexibility to create their own matrix case arrangements brought the same flexibility users already enjoyed with the Monotype hot-metal caster. Monotype's traditional user base comprised general commercial printers, and book printers and publishers who needed accented characters, non-Latin characters, pi, and mathematics characters on a regular basis. They could also order any character to be specially manufactured for them. Separate matrices also resulted in fewer baseline-alignment problems. In addition, separate mats were familiar to users, and allowed Monotype to achieve the quality of image which they strove for. Thus, even though the Monophoto Mark 2 had a matrix case of 272 individual matrices as against the 1440 fixed characters of the Photon disc, character flexibility made it more commercially acceptable. I would suggest that this development was probably largely influenced by Monotype's own caster technology.

The second of the critical developments was Monotype's eventual acceptance that the way forward in developing phototypesetting systems depended on electronics rather than mechanics. It took them a long time, and Monotype's first electronic machine, the Monophoto 600, was unnecessarily complex. Monotype's first demonstration model of 1969 came a full 15 years after the first trial Photon. The Monophoto 600 was expensive, so it was hardly a response to Compugraphic's low-cost machines released a year earlier. It operated at a minimum of 16 c.p.s: at-least four times the speed of a Mark 5 machine. I think we can therefore safely say that the Monophoto 600 was essentially Monotype's general response to the speeds being reached by other machines of the time (e.g. the 80 c.p.s. of the Linotron 505), whilst trying to maintain the output quality and some of the flexibility expected by Monotype's traditional general commercial market (i.e. the stationary matrices and the flexibility of the pi carousel).

The third of my suggested critical developments was Monotype's early adoption of the laser in a new generation of machine and their appreciation of the shift towards complete page composition of text and image seen in the first release of the Lasercomp in 1976. This I suggest was Monotype's response to the Linotron 505 and the Hell Digiset of the mid-60s, but whereas the two critical developments



already identified so far were essentially *responses* to other technologies, this one was truly *revolutionary*. As such it saved the company from its established pattern of simply responding to other technologies. On its release in 1976 the Lasercomp was capable literally of leaving the competition standing: but, despite having had the market effectively to itself for almost 10 years, there were many reasons why Monotype failed to capitalize on the opportunity the machine afforded. Although the Lasercomp imaged whole pages of text and graphics it was five years or so before good graphics software was made available, and a further three years before Monotype released a graphics terminal (and even then these systems did not allow full page make up). In the early years therefore its capabilities were not fully realised. At £40,000 many users found the early Lasercomp's inefficiency in this respect difficult to justify and Monotype itself never agreed a business partnership with a manufacturer of front-end systems.

Interestingly, up to 1976 Monotype had aimed its machines at the general commercial market. But the Lasercomp was a development in absolutely the opposite direction: its capabilities were aimed straight at the newspaper market (though it took a while for Monotype to fully grasp this, and two early installations, for example, were at book printers and publishers – CUP and Clays). This shift in emphasis took its toll internally: many key staff failed to appreciate the very different requirements of the new market Monotype now aimed itself at, and this resulted in ineffective marketing, wasteful internal power struggles, and unhealthy lengthened mourning of the gradual decline in Monotype's traditional market base.

*Why install Monophoto? – the arguments Monotype used*

As I mentioned earlier comparing the purchase cost of one manufacturer's machine with another does not necessarily provide a useful or valid comparison. One has to additionally compare the cost of accessories, operating costs, staffing, and maintenance. In the late 50s Monotype argued that taking all this into account pointed to the better economy of Monotype machines for their traditional general commercial user base.

A Monophoto Mark 2 filmsetter ran at three c.p.s: roughly the same speed as a skilled keyboard operator. The Monophoto therefore needed only one keyboard to achieve optimum output. One filmsetter plus one keyboard cost £12,000, so the capital outlay per keyboard was £12,000. In addition one had to allow the costs of one keyboard operator and one person to oversee the filmsetting unit. As for maintenance, Monotype argued that familiarity and the reliabil-

ity of the mechanics meant these overheads were minimized. They argued that one man could easily oversee two filmsetters, so an economical installation would comprise three men operating two keyboards and two filmsetters. This would achieve productivity of 5333 characters per hour per man at a cost of £24000 (i.e. capital investment of £8000 per man).

The Photon, however, claimed photo-unit output speeds of 10 c.p.s. (although, once font-selection disc-positioning and film feed were allowed for, a figure of eight c.p.s. was more realistic). Monotype, in its calculations, used the figure of 25,000 characters per hour. But a skilled keyboard operator would still only be capable of two or three c.p.s. – i.e. 8000 characters per hour – so three keyboard units were required to ensure optimum output from one output device. (The first Photon was direct entry, and hence very inefficient: later production models corrected this problem.) One output device plus three keyboards cost around £33,000, so the capital outlay per keyboard was £11,000. In addition one had to allow the costs of three keyboard operators and one person to oversee the filmsetting unit. A Photon installation therefore achieved maximum productivity of 6000 characters per hour per man (24,000/4) at a cost of £33,000 (i.e. capital investment of £8250 per man). (Monotype actually argued that since the electronics of the machine were complex and prone to break down then an additional electrical engineer was required and productivity dropped to 4800 characters per hour per man (24,000/5). Indeed, in his description of ‘The early days of Lumitype at Crosfield Electronics’ published in the 1995 proceedings of the Lyon Lumitype-Photon conference, Brian Mulholland notes that the earliest British Photon installations were initially ‘beset with reliability problems’, but that the identification of a faulty batch of relay contacts solved most of the problems.<sup>10</sup> He also acknowledges that early customers were nervous of the new electromagnetic and electronic hardware, and that there was a distinct lack of knowledge of the technology in the printing industry.)

Put simply, Monotype argued that speeds and cost when calculated in terms of characters per man-hour were similar (though they often glossed over the fact that Monotype’s machines required more staff in post-output page-make-up – or film-stripping – whereas the Photon’s font-mixing capabilities reduced this overhead).

The speed of the Photon did make it attractive to newspaper publishers of course. As did the Photon’s ability to mix fonts and sizes on the fly – to set complete display ads for example. But once Monotype’s salesmen were able to convince non-newspaper publishers and printers – i.e. their traditional market – that speed-to-cost com-

10. Brian Mulholland, ‘The early days of Lumitype at Crosfield Electronics’ in Alan Marshall (ed.) *La Lumitype-Photon* Proceedings of the conference at the Musée de l’imprimerie et de la banque (Lyon, October 1994) p. 99.

parisons were similar across different technologies, they then argued the case for Monophoto on the grounds of, for example:

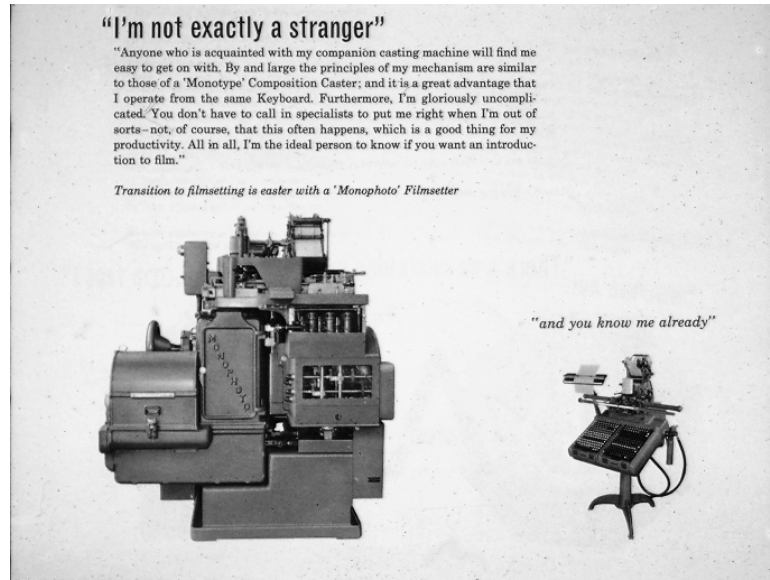
- the versatility, functionality, and familiarity of the matrix case containing individual removable matrices – hot-metal customers were already familiar with this.
- the range and quality of typefaces from the Monotype type library which were fairly rapidly adapted for photocomposition, and which Monotype soon supplemented with new faces designed specifically for photocomposition by leading designers, such as Adrian Frutiger and José Mendoza.
- the reliability of the Monotype machine when considered against the troublesome nature of electronics. Monotype played on customer's fears, suggesting that machines producing thousands of characters per hour resulted in millions of switching operations in a few days, and that in a matter of weeks this could result in the burning out of switch contacts, and the wearing out of electrical components. Again Monotype hot-metal users were already familiar with the reliability of the mechanics.
- the quality of output from Monotype's stationery matrix, the Monophoto's adoption of the hot-metal caster's superior spacing and justification technologies, and the quality of character outlines which were optimized for multiple size output by Monotype's highly skilled and experienced type drawing office – again, much of this the customer was already familiar with.
- the capability to set many sizes from one character negative as a new asset: users of Monophoto systems could therefore build their type collection more quickly than with metal.

A constant theme running through much of Monotype's arguments is that of familiarity. Indeed, Monotype saw the similarity of their filmsetter and keyboard to the Monotype hot-metal caster and keyboard as one of their most valuable marketing assets. It was used repeatedly in marketing brochures and advertising. 'A machine working on established principles...', the company said in the *Monotype Recorder*, '... is far less fearsome to printers and its dependability has been proved, by proxy at any rate, over many years.'<sup>11</sup>

Some customers saw staff re-training as the biggest hurdle to changing over to phototypesetting. When companies who did *not* have an existing typesetting operation still made the decision to buy Monophoto filmsetters, Monotype of course made much of this in their publicity materials. Photoprint Plates, for example, the company who purchased the first European Monophoto installation, were a case in point.

11. *Monotype Recorder*, 43/2 (1965) p. 6.

15 Monophoto marketing material



Beatrice Warde in her inimitable marketing-speak pronounced in the early 1960s:

It is safe to say that hundreds if not thousands of practical printers began for the first time to imagine themselves, however fleetingly and tentatively, as 'going over to film', as the result of being able to envisage that transit as no mere catwalk across untried planks, but an orderly progress across a bridge of familiarity that was obviously solid enough at the start to allow their own 'Monotype' Keyboards to be taken across intact – and, beyond that, one on which the general mechanical principles of a 'Monotype' Composition Caster would be reassuringly recognizable in the new Filmsetter.

Though these arguments may have had some basis in the late 1950s and early 1960s, by the time the Monophoto 600 came along in the early 1970s they had worn thin. The quality of the exposed image and the quality of the typeface library were still valid reasons why some of Monotype's traditional user base continued to use Monophoto equipment, but the extraordinary delay in accepting electronics and computing, coupled with the high costs of the 600 and later 400 machines alienated many. Monotype turned down the opportunity to market Compugraphic's CG2961, and also the opportunity to develop the 505 technology with Purdy and McIntosh, largely due to the management's insistence on marketing only Monotype-developed systems.

This mentality allowed them to fund David Hedgeland's Cambridge group in the development of the Lasercomp, and Monotype

were indeed extremely fortunate to have such a visionary. How sad, therefore, that though the Lasercomp was the very internally-developed technology the company wanted, the management failed to capitalize on the supreme market advantage it afforded.