D·I·G·I·T·A·L TYPOGRAPHY

DESIGN ▪ AND ▪ PRODUCTION

GILLIAN MURPHY

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THE DESIGN AND PRODUCTION OF DIGITAL TYPOGRAPHY

Gillian Murphy
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INTRODUCTION

In the field of graphic design the design and production of typefaces, both for text and display purposes, is an area which receives very little publicity. Yet it is a necessary art and one we encounter everyday of our lives. For centuries typefaces were steadfastly produced from metal punches, made either by hand or mechanically produced. The twentieth century saw the introduction of photocomposition but it is only in the last decade that there has been a major change in the type production industry with the introduction of the computer. However it is not only the production procedure that is changing, but also the very nature of the type being produced i.e. it is no longer the familiar analogue format but instead the image is comprised of a grid-like structure composed of many individual elements, or dots, that spend most of their time in a computer memory. The very nature of this transition from the tangible analogue character with its metal punch or photographic negative, to the intangible nature of the character stored in a computer memory to be finally produced in atomised form, requires a totally different approach not only to type production in general but, more importantly, to type design, with particular attention necessary in one specific area of the industry. This thesis will therefore be discussing the overall changes in the production procedure and will be highlighting the problems incurred in the area of designing for this new system.

In order to discuss this modern concept of digitised type fonts it is necessary to re-cap briefly on the history of type production from the onset of printing to the present day, with a view to examining if and how these different processes have affected the shapes of the letters we read today. Particular attention will be paid to whether this modern system affects the shape of our traditional type faces.

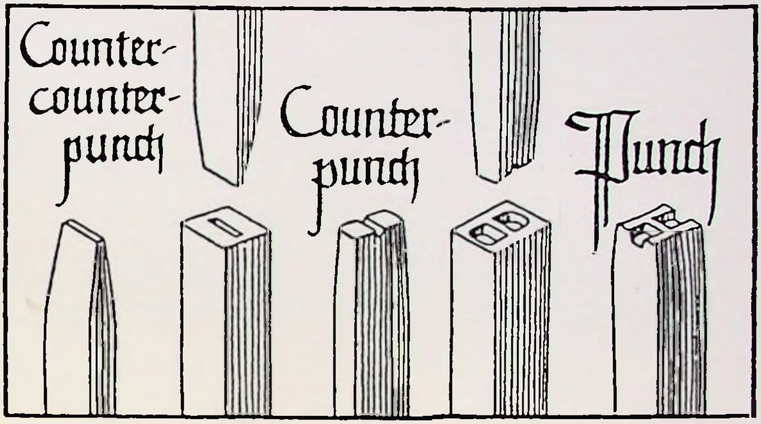
The actual process involved in digitising a typeface will be examined with a view to how the computer can not only produce type but how it can also assist in the design process as well. The necessary factors involved in the process of designing a typeface under normal circumstances will be discussed and then compared to the intensive approach required in designing for digitised output. This different approach is necessary in specific areas of digitised output because, although revolutionary, this modern system still exhibits extreme limitations at the lower, less technically developed end of the production scale and it is this area, known as 'low resolution', that produces type for the average business equipment as opposed to the higher, more expensive end of the production scale which produces type for the professional typesetting industry. It will therefore highlight how now, more than ever before, designers have to redress and familiarise themselves with all the basic fundamental rules applicable to typography design in order to overcome the technical limitations that are still inherent at the low resolution end of the industry despite its many advantages.

To highlight this problem a low resolution type face, 'Lucida', will then be discussed in detail with regard to its initial concept, design and production. This will then be compared to a high resolution design by the same designer in order to illustrate the different approaches in the design of the two faces.

Chapter I

THE SEQUENTIAL PROCESS OF TYPE PRODUCTION FROM THE FIFTEENTH CENTURY TO THE TWENTIETH CENTURY.

- PUNCHMAKING
- MECHANISATION
- THE PANTOGRAPHIC PROCESS
- THE INTRODUCTION OF THE KEYBOARD
- TYPESETTING
- COMPUTERS
- THE ADVANTAGES OF DIGITAL TYPOGRAPHY



The counter-punch.

FIG: 1

Chapter I

THE SEQUENTIAL PROCESS OF TYPE PRODUCTION FROM THE FIFTEENTH CENTURY TO THE TWENTIETH CENTURY

In order to fully understand the modern concept of digital typography it is necessary to briefly outline the varous processes involved in the production of type from the onset of printing. For over four hundred years, from the middle of the fifteenth century to the beginning of the twentieth century, the making of type was unchanged. It involved four definite handcrafts, namely:

. the cutting of letter punches;
. the striking of matrices;
. the casting of the type;
. the preparation of the type for use by the printer.

PUNCHMAKING

Punch engraving was usually undertaken by a skilled craftsperson called a punchcutter who worked from the drawings of a type designer. The punch was a short metal bar approximately two inches high, on the top of which was engraved a single letter in relief. The process was lengthy, however, as any letter that contained an interior enclosed space (e.g. b, o, a, g) needed to have a counter punch made containing on its head, in relief, the shape of this interior space. This counter punch would then be driven into the face of the actual punch, thereby creating an intaglio counter after which the unwanted metal would be filed away from the relief letter form.* Having done this, the finished character would be held in the smoke of a lamp or candle flame until it was blackened and then pressed onto paper in order to compare its image beside already

*See Figure 1

completed characters in the same font. If approved, the punch metal was hardened so that it could be struck into a small bar of copper, this being a suitably soft metal, thereby creating a intaglio or recessed matrix which is a mould for casting. Justification was always necessary here due to the displacement caused by the strike. The face of the bar would be lowered until the depth of the strike was correct. This matrix was then given to a type caster who placed it at the bottom of a funnel like mould into which was poured a molten alloy of lead, tin antimony and copper. The letter would then reappear once again in a form almost identical to the original punch: a long shaft of metal with the character sculpted at the top. When a sufficient number of these had been made they would be assembled in a line. The bottom ends, or 'feet', would be cleared of extraneous metal and identifying nicks would be grooved into the shanks. They are now ready to be placed in a form for printing and so we see how the punch is not an end in itself but a means to an end.

MECHANISATION

The invention of steam power made mechanisaton possible in every aspect of industry and type founding was no exception. A machine had already been developed for the rapid casting of type by the early nineteenth century. By the end of that same century a process had been developed whereby 'punchcutting' and 'matrix striking' had been replaced by the engraving of the character directly into the blank copper plate. Unfortunately this only proved successful in fairly large tye sizes and for designs in which rounded angles, due to the powered rotating cutting tools, were tolerable.

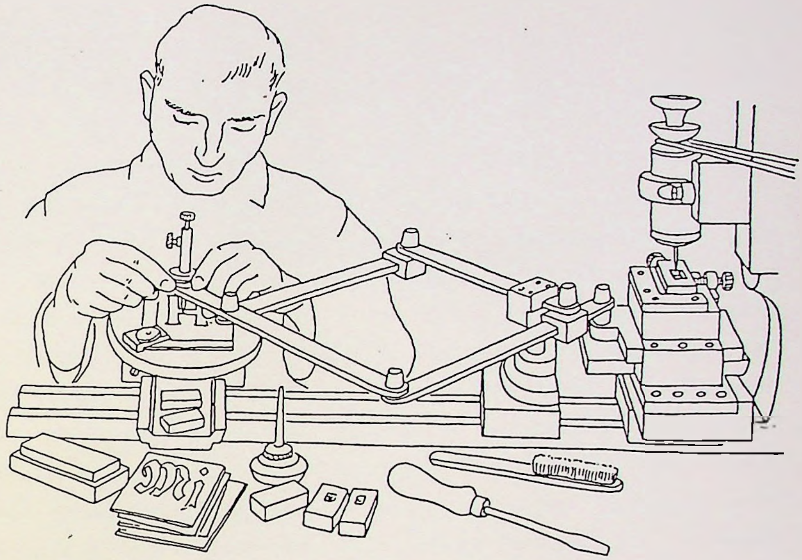


FIG. 2

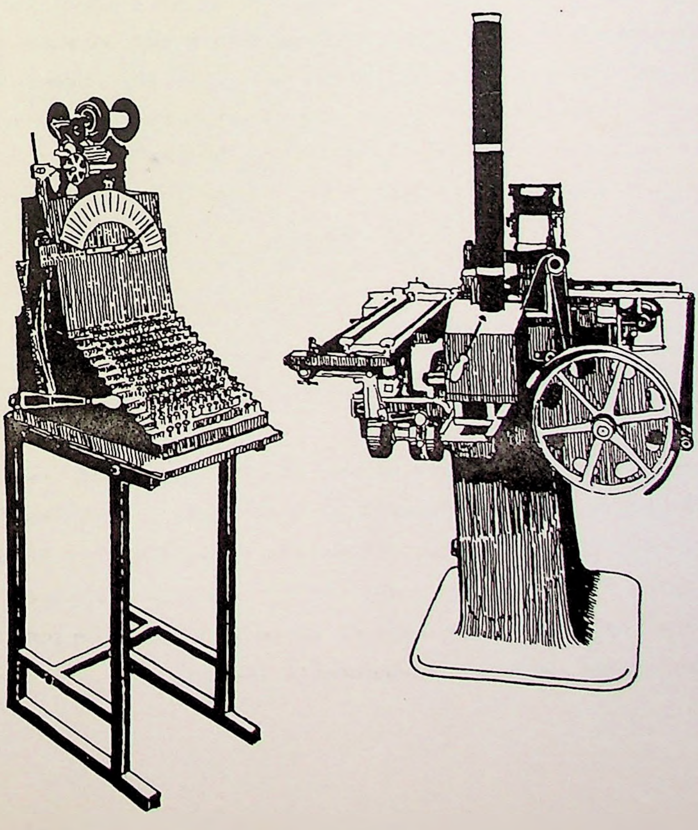


FIG. 3.

THE PANTOGRAPHIC PROCESS

The pantographic process of mechanical punchcutting, however, marked a major step forward. This process involved the physical usage of original master drawings by the designer, scaled up to a height of approximately ten inches. This drawing was positioned at one end of the pantographic machine while a wax coated metal plate was locked in place at the other. The machine operator then carefully traced the outline of the large original with the extended pantographic machine arm on the other end of which the movement was being imitated in miniature on to the waxed plate, removing the surface wax.* The exposed section of plate was electrolytically coated with copper. The result was an accurate representation of the character, approximately one quarter the size of the drawing, and in firm relief. Many variations based on this particular method existed but the most important factor to note is that now, for the first time, definite master drawings from the designer were a necessary physical factor in the formation of metal characters. This marked the change from a manual craft (punchcutting) to a form of precision engineering (pantographic engraving).

INTRODUCTION OF THE KEYBOARD

The monotype machine, developed at the end of the last century, speeded up the process of type composition formerly done by hand, by the introductin of 'code'. It consisted of two machines, a keyboard and a caster.** The text to be set was typed on this keyboard but the letters were produced in the form of coded punches or holes on a paper tape. The coded tape was subsequently fed into the caster

* See Figure 2
**See Figure 3

machine where it controlled the position of a diecase containing the matrices over the casting point. The letteres were instantly and individually cast and then ejected into lines ready for the printing process. This combination of keyboard and automatic casting of metal type has now completely disappeared from the typesetting industry . It is evident that the last quarter of this century has become the era of electronic typesetting and it the computer that has made it possible. The computer, originally a very clumsy affair, was developed during the Second World War; by the late 1940s / early 1950s, however, its size became more manageable and therefore, convenient.

PHOTOTYPESETTING

The established manufacturers of composing machines set obout the task of converting the output of keyboard composing machines from metal to photographic plates. It is here that we wee the advantage of the accumulation, since the early part of the century, of those original 'character drawings' as the master character copy for the photographic process. Set metal type (which had been basically the same since Gutenberg) was now no longer physically utilised for the purpose of printing. Formerly, metal type cast in relief as set, inked and pressed against paper. It now only needed to be proofed once to provide a perfect master copy of the text to be printed. This was then photographed to produce a flexible lithographic plate: it was this plate that went into the printing process.

While revolutionising the printing industry lithography left typesetters with the laborious task of setting type as if for conventional metal type printing, only to have it photographed! It was therefore necessary to try and dispense with the physical use of metal type altogether. This seemingly impossible task was realised with the first generation of filmsetters. Monophoto, first developed in 1952, worked basically on the same principle as the previously mentioned Monotype machine. A perforated tape from a keyboard unit was fed into a composing machine, thus determining the position of the diecase which now holds negatives of the individual characters instead of matrices or moulds. These negatives are exposed in sequence on film or light sensitive paper with an adjustable lens unit to determine the size of the typeface. Although considerably faster than the previous method of automatic casting, it was not fast enough and a high speed output is what most typesetters were now looking for.

COMPUTERS

As a result, we now see the implementation of the computer in the actual production of the typefaces themselves with the replacement of the lens by a Cathode Ray Tube (C.R.T.), a sophisticated version of the object that forms our television screen. The essential difference between the C.R.T. and the photographic composing machine is that instead of ending up with the solid characters, the resulting letters are formed by individual slices of light. Under close inspection the curves and diagonals of the letters appear stepped, the size of the steps corresponding exactly with the size of the light spot. This original introduction of the Cathode Ray Tube and, later, the laser beam in type composition to speedily assist in layout and justification marks a considerable advance, but not as much of an advance as the replacement of the actual character negative by digitisation. With this new process the character is no longer a tangible physical entity that you can touch but, instead, is comprised of 'bits' or mathematical co-ordinates similar to a grid of squares, each of which is recorded as an electronic signal to be stored on a disc. These can then be recalled as an intelligble shape i.e. a letter by the modern micro computer at a speed of approximately one A4 page every fifteen seconds. The typesetting machine operates extremely quickly, building up the letters square by square or 'bit' by 'bit', horizontally across the page in a series of sweeps. A curve is therefore described as a succession of steps which will only be apparent to the naked eye on coarse resolution output. The traditional letter as we know it is not digital but is analogue i.e. physical in property as opposed to a set of intangible co-ordinates in a computer memory. With the development of the computer and digital electronics, typography in the past twenty years has been seeing a gradual replacement of analogue text by digital text and we are really only now becoming aware of it. According to Charles Bigelow, Professor of Typography at Stanford University, California, this changeover

"may rival the shift in the Renaissance from script to print".*

THE ADVANTAGES OF TYPOGRAPHY

The advantages of digital typography are substantial. Because the letterforms are represented literally as coded dots, they can be called up or transferred by a computer as pulses of current and decoded to reconstitute letterforms for the person receiving the

*Ref Bibliography No 8: Chapter 5

message. Once type is digitised it is effectively translated into computer language and therefore can be easily modified by a program. Unlike analogue typefaces, digital typefaces are more resistant to wear and tear. Digital typography can be adapted to a wide variety of output devices e.g. daily newspapers, magazines, laser printers for office usage and televison.

Chapter II

THE INFLUENCE OF THE METHOD OF TYPE PRODUCTION ON THE SHAPE AND QUALITY OF LETTERS

- THE PUNCH
- MECHANICAL PUNCHCUTTING
- PHOTOCOMPOSITION
- DIGITISATION

Chapter II

THE INFLUENCE OF THE METHOD OF TYPE PRODUCTION ON THE SHAPE AND QUALITY OF LETTERS

In order to understand how digitisation effects the shape of letterforms it is necessary to examine the effects, if any, on type through the various methods described in Chapter I.

THE PUNCH

With the onset of printing, a handcraft evolved that lasted well over four centuries - namely punchcutting. The physical act of shaping a punch enforced absolutely no restrictions or limitations on the shape, size, style or detail of a character. The letter could be any width while serifs and angles could be as bold or as detailed as required, as the soft metal was being cut away and not incised. In other words, the medium or material itself presented no barriers. It is necessary to state at this point, however, that the type designer and the punchcutter were rarely one and the same person. Although an able craftsman, it was unusual to find the punchcutter proficient in a knowledge of type design in addition to his cutting skill. The designer would therefore submit his master drawings and it was the job of the punchcutter to faithfully and accurately represent this design on the head of his punch.

MECHANICAL PUNCHCUTTING

With the introduction of mechanical punchcutting or engraving one finds even more accurate reproduction of the original drawings through a tracing process involving the use of an enlarged version of this drawing (approximately ten inches high) whose form is traced by the machine operator (as described in Chapter I) to produce a miniature replica and perhaps an even more faithful representatin than the manual punchcutter could ever achieve. Despite this, this system still came up against much criticism from writers on the subject of type design. Updike is quoted as saying in 1922

> "I have sometimes questioned whether a machine can be so managed that it will ever produce those fine and imperceptible qualities of design given to it by the hand of a clever type cutter".*

Perhaps more accurate representation was too rigid for the likes of Updike or even Jan Van Krimpen who, in reference to these slight imperfections of hand and eye found in manual work, thought them

> "an important element of the charms of hand cut types".*

But despite all this, mechanical punchcutting was definitely not a restriction on letter appearance through accurate representation, but it was a restriction in one important area, that has contrived to be a problem to this day. Unlike the punchcutter who optically compensated by modifying lowercase x height and letter width to maintain legibility in small sizes and elegance in larger ones, the mechanical punchcutter working on the 'pantographic' principle had the facility of fine adjustment. He could therefore produce several sizes of punches from a single pattern therby dispensing with the need of additional drawings from the type designer for the different sizes incorporating the essential optical compensation. You could say mechanisation overcame aesthetics. The end result was that

*Ref Bibliography No 8: Chapter 5

although the actual letter shapes or quality was unchanged, in fact probably improved, the overall legibility was at risk.

PHOTOCOMPOSITION

With photocomposition the 'quality' of the character depends entirely on exposure consistency. The letters themselves are subject to quality variations in detail through loss of fine line and angles, through filling in and again, as in mechanical punchcutting, through the production of many sizes of type from one master design. Optical compensation again loses out to facilitate easy production. To re-cap, therefore, certain mechanical principles in these machines imposed certain constraints on the proportions but not on the original shapes, details and edge quality of their face. In point of fact, the faces are really unchanged from the designs being produced from the former punchcutting and hand casting method.

DIGITISATION

So how does digitisation effect the way type looks today as opposed to its analogue predecessors? As previously explained, digital type is a form of fragmentation, an atomised version of the design, as a series of discrete steps. For the first time the profiles of the characters are being altered. As soon as the Cathode Ray Tube (C.R.T.) and laser beams became popular in electronic typesetting systems, 'resolution' became a very important term. Whether we can are now confronted with a situation whereby designers have to familiarise themselves once again with the basic rules of good typography, legibiltiy and readability, in order to overcome this problem. With low resolution the subtleties of serifs and curves have to be curtailed or, worse still, removed completely resulting in a definite loss of legibility if not the distinctiveness of the characters themselves. The initial process of digitising a typeface from th designer's drawings is lengthy and expensive. How does one tackle the problem, therefore, of implementing a typeface to be used in both high and low resolution output? Does one allow this crudeness in appearance to take place as the resolution gets lower or does one develop instead an average master font design that deprives the high resolution design of its finer qualities in order that the low resolution face be presentable? Or should each resolution have its own collection of faces which incorporates good design within its production limitations? These are just some of the problems that exist while this technology is still in its infantile stage but they are problems we cannot ignore and this thesis shall attempt to answer them.

Therefore, we can see that the medium involved in the craft of punchcutting held no ' restrictions' on the shape of the letter designed by the type designer except in its exhibition of slight imperfections that were considered a charm in hand cut types. Mechanical punchcutting improved the accuracy of respresentation of shape but disimproved the overall quality of type legibility by not allowing for optical compensation. Photocompostion merely reproduced printed metal type therefore the medium did not hinder the shape as much as quality which necessitated consistency of exposure. Digitisation however exhibits two extremes of production with regard to quality and shape. High resolution output produces perfect quality type with no alterations to shape. Low resolution on the other hand exhibits more restrictions than any other process so far by not only hindering the character shapes but by completely distorting them.

Chapter III

THE PROCESS OF DIGITISATION

- THE OUTLINE DRAWING

- THE PROCESS OF 'IN HOUSE' DIGITISATION
  - Alignment
  - Scanning
  - Editing

- SPACE ECONOMY DIGITISING
  - Run-lenth Encoding
  - Spline-knot Encoding

- THE COMPUTER AS A DESIGN AIDING SYSTEM
  - Ikarus
  - Metafont

Chapter III
THE PROCESS OF DIGITISATION

Digitising type involves two distinctly different approaches that take into account the amount of storage space a computer program has to offer. This Chapter will explain these two processes and how they evolve from the important original character drawings and how also the influence of the typographic expert is necessary in these technological procedures. It will also examine briefly the role of the computer as a design aiding system as well as a type producer.

THE OUTLINE DRAWING

There are several methods of digitising type and like previous methods of metal composition and photocomposition (as discussed in Chapter I) they also require the physical use of the large original outline drawing of the individual characters of a type font. In order to understand the process of digitisation it is therefore necessary to explain the role these drawings play.

As we know a simplified explanation of digitisation would be the reduction of a solid image or character to a series of squares; in other words, a fragmented image. For this conversion to take place therefore a good original is necessary. If you tried to simply photographically enlarge, for example, a 24pt character from an existing font to about three inches the result would be lumpy and ugly. Distortion would take place and the edges would be broken and irregular scanning, which is the actual process that reduces solid images to fragmented ones, requires the use of large originals. If these originals are not therefore perfect the scanned or digitised result will obviously, likewise, be impaired and the overall typeface produced will be bad and inconsistent in quality. The outline drawings can be scanned at many different resolutions to ensure quality at the different point sizes e.g. 8pt, 10pt, 12pt etc. These drawings are also required as the basis for use in special software programs involved in the designing of digitised typefaces as opposed to the production of digitised typefaces.

The most important point to note at this stage however is where and when this process of scanning takes place with regard to the 'laser printer' itself i.e. the output system. Scanning can take place at the manufacturers, before it reaches the laser printer, or it can take place within the laser printer itself. In the first example where the characters are scanned at the manufacturers, storage of the characters in the printer takes place in 'bit map' form i.e. fragmentation. The manufacturers produce scanned versions at each point size and these 'bit maps' live in the printer. The advantage of this method of storage is that it produces a good quality output. The disadvantage is that it utilises a lot of computer storage space to keep all this bit map (or 'mathematical co-ordinate') information on each character at each point size. The second process involves the storage of the characters only in outline form in the printer. The printer then receives your instructions about the size of type you require. It then scans the character(s) that you require, itself, and produces it in 'bit map' form. The advantage of this system is that it utilises much less computer storage space allowing for the production of bigger font sizes in the same typeface than the previous method. But the disadvantage is that this process, at the moment, still cannot produce its scanned output to the quality of the manufacturer's scanning. Referred to as the 'scalable font' process, it is however

FIG: 4.A

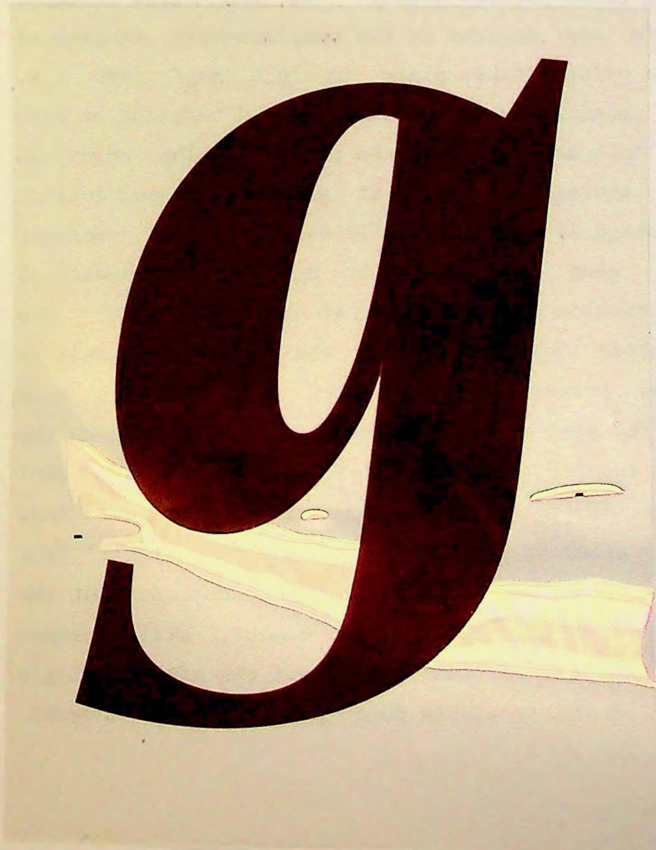


FIG: 4B.

a very popular process.

THE PROCESS OF 'IN HOUSE' DIGITISATION

For the process of scanning at the manufacturers, the original large outline drawing of the character to be digitised must be converted into a solid image. This is achieved by the accurate registering of the outline drawing on a light box under a fixed sheet of transparent red masking film known as 'rubylith'. A trained cutter then skillfully traces the outline of the letter free hand with a blade.* Because red acts as black in the photographic process, this character, referred to as a 'frisket', serves as a positive for the scanning process which converts the analogue or solid property of the original film character into a grid of squares or 'pixels' (picture elements) which are then stored as code or mathematical co-ordinates in the output computer's memory.

ALIGNMENT

Registration in the scanning process is very important because the scanning of a character is undertaken against a grid made up of horizontal and vertical lines. Careful alignment of individual characters is therfore important to ensure that they are positioned accurately i.e. in a correct upright position. If the character is aligned incorrectly at the scanning stage, it will remain incorrectly aligned at the output stage and no amount of adjustment can rectify it because to do so each individual pixel would have to change its co-ordinate or position on the grid. Letters such as l,

*See Figure 4

FIG: 5

m, n, r, i, d, u, x, e, h, comprising of less than half the alphabet have inbuilt in their structures definite bases or feet upon which they can securely stand upright.* The other letters of the alphabet however such as the rounded e, c, o, the pointed v and w, and the awkwardly positioned g and f need careful treatment because of their lack of a base, so that they will appear to be aligned with the other characters after scanning.

SCANNING

In very simplified terms, scanning involves the reading of a solid image in a series of horizontal and vertical sweeps by means of a light source that detects the structure of a character by sensing the changeover from the positive of the character itself to the negative of the background. Scanning can be done by one of two methods. Rotary scanning involves the mounting of the original 'rubylith' character film on a rotating drum. This process is very similar to the conventional four colour separation scanning procedure used in artwork for printing today. However, considering that there are usually seventy-five characters in any given font not including punctuation marks and now each of these has to be scanned individually this particular method is very time consuming. The second method involves a more sophisticated Cathode Ray Tube (C.R.T.) flat bed scanner which because it is flat allows for the easier registration and alignment of characters as well as facilitation for more than one letter at a time.

*See Figure 5

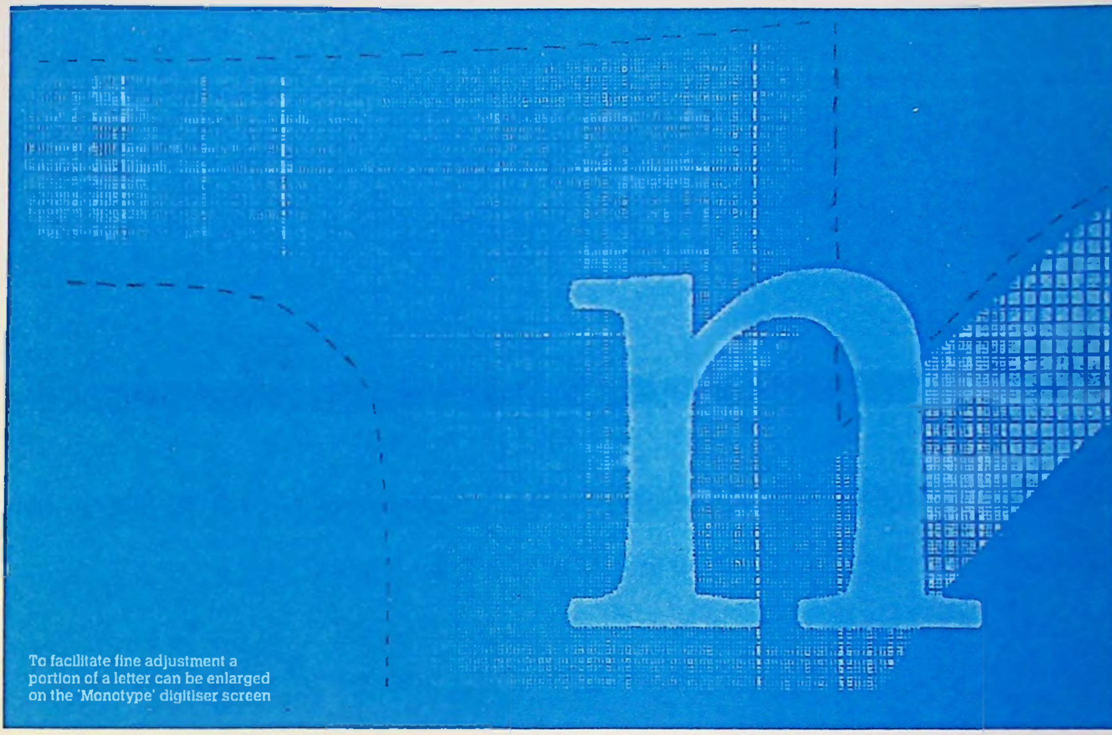

To facilitate fine adjustment a portion of a letter can be enlarged on the 'Monotype' digitiser screen

FIG: 6:

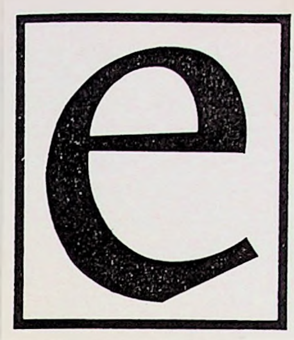
EDITING

After scanning the digitised character or 'raw data' as it now referred to must be edited on a visual display terminal. It is here that the typographic expertise is required over and above a knowledge of operating a computer program and if it is an original design as opposed to an adaptation of an old design, where the designer him/herself would offer consultation. This is because it is here that decisions have to be made about the removal of or the addition of 'pixels' (picture elements) on a given character in order to change or improve curves and diagonals, as many pixels can actually stray in the scanning process. The operator of this terminal can enlarge sections of the displayed character on the screen to see in more detail the individual pixels that make up the grid that forms the character.* When all the characters of a font have been edited, they have to be tested as text and, if necessary, revised again. When the editing is complete the information or co-ordinates are stored on discs.

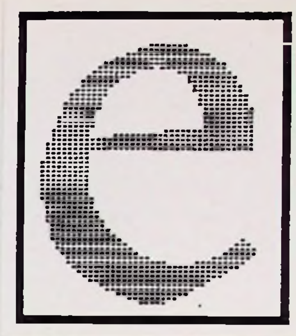
SPACE ECONOMY DIGITISATION

As you can imagine the process of scanning that produces individual pixels just discussed, requires a lot of storage space on a computer system. There is however a more economical strategy for storing the character in the computer memory by taking advantage of the overall regularity of its design and then allowing for the process of scanning to actually take place within the computer itself. There are two different methods by which this can be done and they are referred to as run-length encoding and spline-knot encoding.

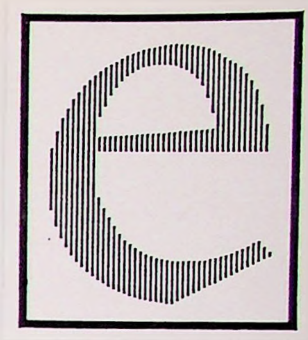
*See Figure 6



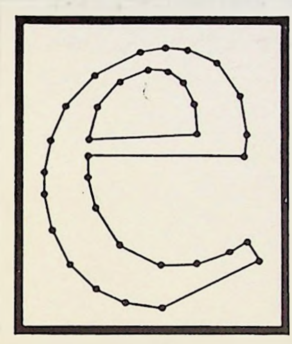
7. A



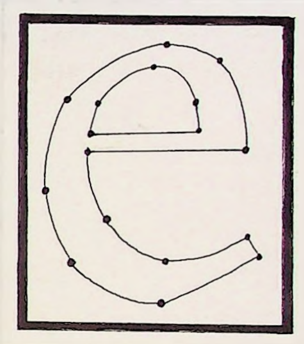
7. B.



7. C.



7. D



7. E

FIG : 7

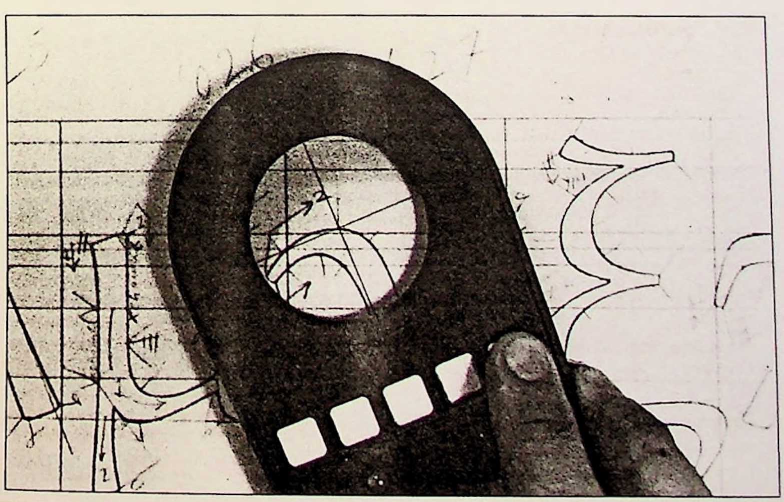


FIG : 8.

RUN-LENGTH ENCODING

This first process involves an initial but more simplified scanning procedure. Instead of scanning horizontally and vertically as the previous method did this procedure scans on one plain only i.e. the vertical plain.* Only the start and stop of each vertical scan line is recorded resulting in a more economical means of storing the data necessary for large sizes of type.

SPLINE-KNOT ENCODING

In an even more economical approach the letter profile is converted into a series of vectors or closely situated points connected by either straight lines or straight lines and arcs.** These points are not just picked at random but are critically selected points called 'spline knots'. These knots or points derived their name from nails used in the process of ship building long ago. Pairs of nails called spline nails were used to bend wooden planks through to shape the hull of a ship. The selection of these knots requires careful consultation between designer and technician, the designer being totally familiar with the shape of the letter and the technician being totally familiar with the process involved in its reproduction. When chosen, the spline knots are recorded as mathematical co-ordinates for imput into the computer by means of a moving cursor. Somewhat similar to a hand calculator# it is moved across the character outline drawing. When the letter is required for output by the computer operator or typesetter the computer is programmed to connect the points forming an outline which the computer then scans to finally produce a finished 'pixelated' or digitised character.

* See Figure 7.B.
**See Figures 7 D AND 7E.
\# See Figure. 8.

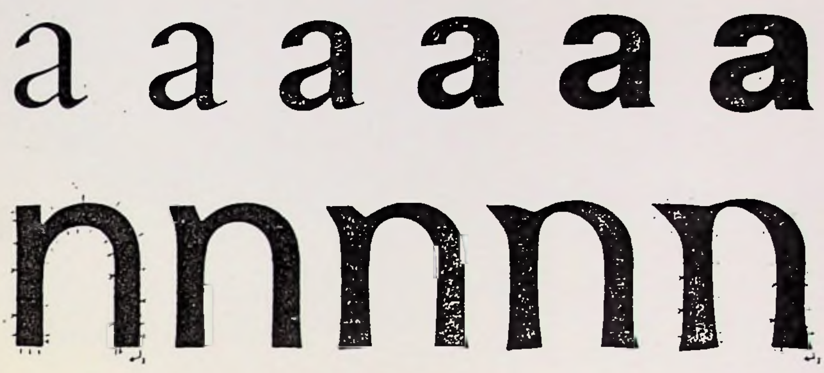


FIG: 9:

THE COMPUTER AS A DESIGN AIDING SYSTEM

IKARUS

As we can see technology improves at an unbelievable rate. The development of various computer programs for digitising type have made many people aware of the potential computers have for actually assisting in the design process as oppoosed to just producing finished type. Ikarus, developed by Dr. Peter Karow of U.R.W. Unternehmensberatung in Hamburg, is one such program. This system can manipulate spline knot based letterforms mentioned earlier and, with this basic outline information, Ikarus can enlarge, reduce, expand and condense typefaces taking into account all the factors imposed by optical compensation, which is where it is a definite improvement on photocomposition. Where the master font was simply enlarged regardless of proportions Ikarus can also create hybrid typeface by mixing information about two separate typefaces together.* Despite all this however, Charles Bigelow, Professor of Typography at Stanford University, California, criticises the difficulties designers have in using Ikarus

> "It does not allow the designer to imitate the process that he would use in designing a font manually".**

What Bigelow means here is that the designer is designing on screen instead of on paper. He has to use a cursor instead of a pencil and he has be be able to convert what he has in his head to algorithmic or mathematical information in order to design.

* See Figure 9
**Ref Bibliography No 18

METAFONT

Another similar system called 'Metafont' developed by Donald Knuth of Stanford University, California, bases its design on ductal principles. Professor Charles Bigelow has put forward three basic letter categories - ductal, glyptal and pictal. Quite simply, ductal letters are letters in which the structure is based on handwritten strokes. Glyptal letters owe their shape to the sculpting process e.g. punchcutting type fonts, while pictal letters are comprised of what one might refer to as 'tattooed' elements on a surface e.g. pixels. Professor Bigelow and his design partner, Kris Holmes, are strong believers in the ductal principle through their argument that there is a handwritten quality to the characters of most languages, that is synonymous with readability. Throughout history, people have tried and failed to produce the Roman alphabet using pure geometry. The handwritten element is always inherent and Metafont is a computer design aiding system that realises this. It operates by being fed, as is Ikarus, the outline or spline dots of a drawn character. It then simply represents the shape of the letter as if it had been written with a nibbed pen the same as the original drawing. However, the advantage comes when you want to alter the nature of the character on the screen because Metafont can alter the letter any way the designer wishes but only with the constraints of the given parameters (i.e. a specific pen nib size, the angle of this fictitious pen in relation to the writing surface and other such variables) creating, as a result, innumerable profile variations based on one character skeleton.

So now we see how digitisation takes places in two distinctly different processes. The first process, involving scanning from the original drawing and then recording the information produced from this scanning, is the most straight forward method, producing good quality output at all the different resolutions. Although this process requires more storage space it also requires less expertise to reproduce the characters than any other process, because design consultation is only required at the editing stage to ensure that the pixels represent the character as faithfully as the original outline drawing. The other process, however, involves the recording of only the character outline, which is then scanned by the computer itself. This process requires much more typographic expertise in conjunction with production knowledge in order to understand where exactly spline knots should be situated and where they should form straight lines and they should form arcs.

So no longer is the production of type purely a craft as it was in punchcutting, or purely a technical operation as it was in photocomposition, but it now requires a unique combination of aesthectics and technology in order to succeed in the successful production of good quality typefaces.

Chapter IV

WHAT IS REQUIRED OF A DESIGNER WHEN HE/SHE IS DESIGNING A TYPEFACE ORDINARILY AND FOR DIGITISED OUTPUT

- THE ROLE OF A TYPEFACE
  - Legibility and Readability
  - Contrast
  - Optical Compensation
- LOW RESOLUTION

Chapter IV

WHAT IS REQUIRED OF A DESIGNER WHEN HE/SHE IS DESIGNING A TYPEFACE ORDINARILY AND FOR DIGITISED OUTPUT

THE ROLE OF A TYPEFACE

The basic fundamental task of a typeface is to transmit information, but it not always that simple. While transmitting this information it is also necessary that type is legible and pleasing to look at. The shapes of letters have interestingly enough persisted longer than any other artifacts in common use and therefore we could probably safely say that legibility is 99% instant recognition. But a successful typeface has to be able to balance two opposing characteristics, 'discriminability' and 'similarity' of alphabetic features. In other words, each individual character must be readily distinguishable from its counterparts yet at the same time it cannot afford to be too distinguishable as a major difference would disturb the flow of reading. In the words of Donald E. Knuth, typographic expert at Stanford University, California

> "A font should be sublime in its appearance but subliminal in its effect".*

LEGIBILITY AND READABILITY

Legibility and readability are two very important aspects in this field of design but according to the typographic expert, Walter Tracy, many people involved in type design unfortunately consider these two terms to mean the same thing. He emphatically states otherwise. He puts forward legibility as meaning "the perception of individual characters - measured by the speed at which individual letters can be recognised".** For example if an 'h' looks like a

* Ref Bibliography No 16
** Ref Bibliography No 8: Chapter 4

FIG 10:

'b', or a '3' looks like an '8' in a given typeface and the reader hesitates, then the character is illegible and badly designed. The term 'readability' on the other hand, according to Tracy, describes comprehension, "the quality of visual comfort over long stretches of test".* Tracy highlights the fact that in designing a typeface legibility is always a necessity while readability is not. For example, legibility is vital when sifting through reference material such as telephone directories, dictionaries and timetables but readability is unimportant here as the reader is not reading continuously but searching for a single item. However, both elements are definitely necessary in the text of a book or even a newspaper.

Letterforms can only be designed using a small repertoire of graphic elements (verticals, horizontals, diagonals and curves). Should technical considerations not allow for diagonals or curves in any production system there would be a serious los of legibility. Clear word shape can only result if the following elements are available: ascenders, descenders, and x height.** These elements give each word its own characteristic shape. According to Charles Bigelow "naive designers emphasise symmetry".# This approach, while it would be most advantageous in the production of digitised typefaces, would be definitely wrong as Bigelow continues by saying the "most readers read just the top half of lowercase characters, if type designers made all the curved letters out of a general mould, the result would inevitably be a hard to read font!"# This, of course, is where the serif (a short finishing stroke to a major stroke) comes into its own because despite what many people consider is a decorative element, the serif serves mainly to highlight letter differences.@ Making serifed typefaces somewhat more legible and therefore more readable for longer passages of text than sans-serifed faces.

*Ref Bibliography No 8
#Ref Bibliography No 18

**See Figure 10.
@ Ref Bibliography No 18

CONTRAST

Contrast is an important factor to consider when designing any typeface for any means of production. This describes the difference between the thickness of the vertical and horizontal stems. In traditional alphabets vertical stems are thicker than horizontal stems, a direct result of the original handwritten faces employing the use of nibbed pens. Too much of a contrast creates a spindly effect that in display type may look well but in text type is very difficult to read. Too little contrast however allows for very little distinction between individual characters. This is a major problem for designers of low resolution digital typefaces because this process with its technological limitations and lack of refinement in production necessitates the use of thicker, bolder characters that can survive the coarse reproduction process thereby immediately endangering character distinction.

OPTICAL COMPENSATION

As mentioned in Chapter II, optical compensation is another important factor in any type design process. Sadly lacking in photocomposition text, designers of digital typefaces will have to reassess the necessity for this procedure again because now typefaces are not only being increased or decreased in size, as they were in the photoreproduction process, but they are also subject to quality degradation as the resolution automatically gets lower with the smaller sizes of type.

This is an example of 12-point Chicago.

This is an example of 12-point bold Pellucida sans serif.

FIG: 11.

LOW RESOLUTION

As mentioned in Chapter I, designing for high resolution output has little or no limitations. A designer can have his work reproduced with virtually no evidence to reveal that his typeface characters are comprised of a grid of minute squares or pixels. Therefore he/she is confined only by the rules of type design mentioned above that have applied anyway to all type designers of the past. However, low resolution, with its coarse output, as we have repeatedly seen, requires special attention in just about every area. Designers have had to devise letterforms that follow the general rules of type design but which can simultaneously survive the coarsening effect of te low resolution grid, where subtle curves play no part and detail loses out. Traditional thinking with regard to digital type constantly sees most designers trying to smooth character edges by the elimination of the stair stepping effect of peripheral pixels, in an effort to maintain character style and detail. However, Professor Bigelow's studies have proven that "shape recognition is more crucial than smoothness of character"* and with this knowledge he has managed to maintain legibility at low resolution output in his designs.** Traditional faces can be adapted to high and medium resolution output production systems which account for most of the sophisticated typesetting equipment available. But they cannot be easily adapted to low resolution devices, which accounts for most office equipment. Just because it is office equipment, and therfore not used by professional typesetters, is not justifiable reason for bad design. Designing specifically therefore, for low resolution would allow medium to high resolution faces to maintain their subtleties, while low resolution could make the most of its limiting production production systems. This is opposed to trying to adapt an old face or even

*Ref Bibliography: **See Figure 11

produce an average design that will maintain maximum legibility across a wide variety of digital displays. Until technology allows for adaptation to take place unaltered, the designing of specific typefaces for low resolution output is the obvious answer.

As a result we can see that designing typefaces for medium and high resolution requires no special attention over and above what is normally required of a typeface in any given situation i.e. legibility and readability, as the output resolution is not a hindrance on the shape or quality of the type itself. But designing for low resolution, on the other hand, involves a comprehensive knowledge and understanding of all the basic rules of typography and a fairly good understanding of the production procedures in order to be able to produce good typefaces with the constraints of this coarse medium.

Chapter V

THE DESIGN AND PRODUCTION OF THE 'LOW RESOLUTION' TYPEFACE LUCIDA

- LUCIDA
- Weight and Contrast
- Serif Shapes
- X Height
- Capitals
- Modularisation

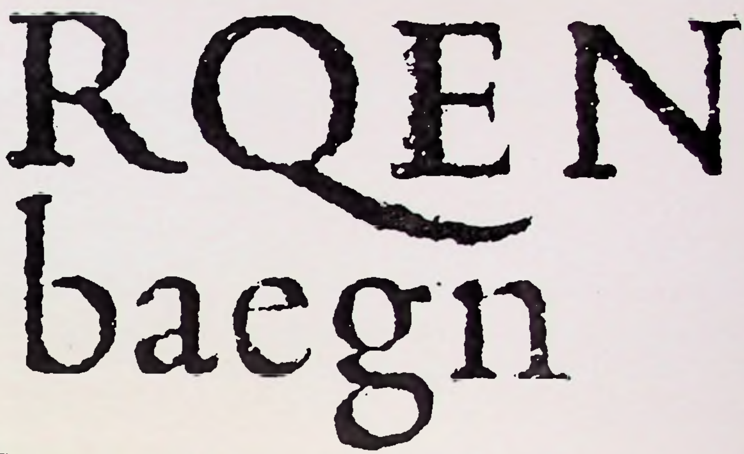
Chapter V

THE DESIGN AND PRODUCTION OF THE 'LOW RESOLUTION' TYPEFACE LUCIDA

This chapter will discuss the concept, design and production procedures involved in the test typeface Lucida, designed specifically for low resolution output. The analysis will highlight the limitations incurred by low resolution output systems and will discuss Lucida's design in relation to these restrictions. An effort will be made to show how a basic fundamental knowledge of all aspects of type and type design involving the rules of legibility and readability must be combined with an equally comprehensive knowledge of the system itself.

LUCIDA

When we say 'low resolution' we are talking about an image comprised of approximately 240 to 480 pixels or dots per inch, which is incidentally about a quarter of the average commercial typesetter, which utilises anything from 1,500 to 6,000 dots per inch. With low resolution we are also talking about laser printers, or your standard piece of office equipment for everyday desktop printing. So, we are talking about type utilised by the average clerical worker as opposed to the professional typesetter. Resolution is a limitation, and quality is determined by how well the designer realises the letterforms within these limitations. At each resolution, optimised designs are possible. Kris Holmes, the type design partner of Professor Charles Bigelow in the San Francisco company of Bigelow & Holmes, considered the urgent need for a good original low resolution typeface as a definite challenge. With her calligraphic training and her adept knowledge of typographic history



Francesco Griffo's roman type for De Aetna, *Venice, 1495. Enlarged.*

FIG: 12.

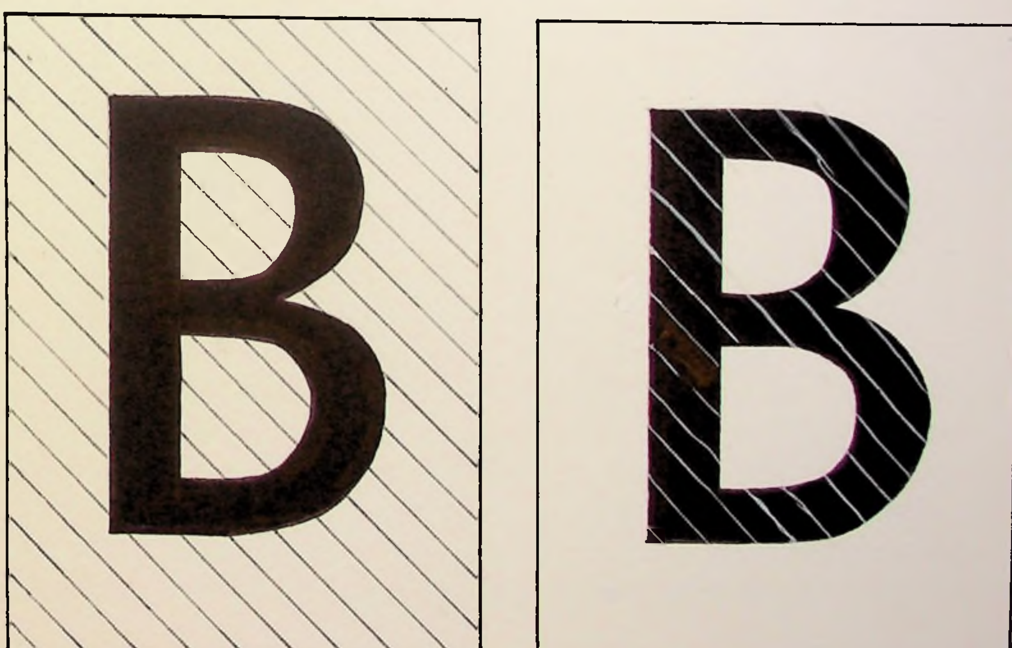


FIG: 13.

both she and Professor Bigelow set about designing the first 'low resolution' typeface Lucida. Inspiration for this typeface came primarily from the work of fifteenth century Renaissance typeface designer Francesco Griffo who worked during the era of profound change in the technology of literacy. Griffo, utilising his medium of metal to make punches, created letterforms that stemmed naturally from the principles of the alphabet but that were no longer handwritten.* The fundamental problem that Griffo found was how to maintain recognition, clarity and vivacity of the test image in a radically changed technology. Bigelow & Holmes faced the same problem today.

The designer for low resolution output has to contend with two contradictory production procedures. Using the action of light on an electronically charged photoreproductive surface, laser printers either print the text itself or the white space around and between the text. The designer must therefore keep this in mind when designing a typeface because in white writing printers i.e. those printing the background as opposed to the letters, details such as hairlines and serifs must accentuated lest they erode while in black writing printers (those that print the text itself) small white spaces like counters must be avoided as they tend to fill in.** Realising all these parameters Ms. Holmes set about the immense task of designing a simple, sturdy yet perfectly legible typeface. In order to discuss the design principles behind her resulting Lucida it is necessary to categorise it under the folowing headings:

. weight and contrast;
. serif shapes;
. x-height;
. capitals;
. modularistion.

* See Figure 12
**See Figure 13


Thicks & Thins
VERTICAL STEMS:
CURVED BOWLS:
MAIN DIAGONALS:
SERIFS:
HAIRLINES:
JOINTS:
THICKS
THINS

FIG: 14.

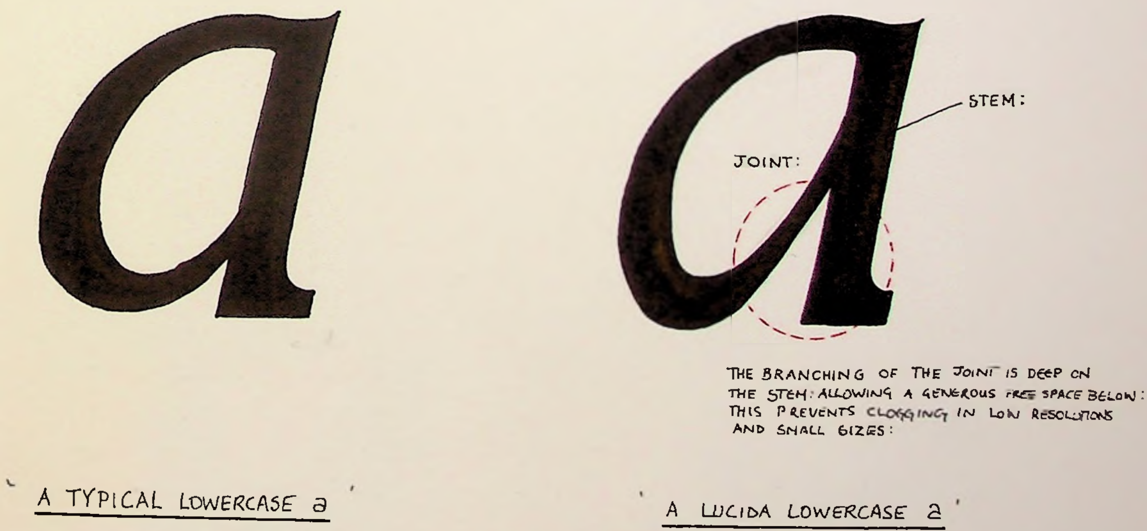

STEM:
JOINT:
THE BRANCHING OF THE JOINT IS DEEP ON THE STEM: ALLOWING A GENEROUS FREE SPACE BELOW: THIS PREVENTS CLOGGING IN LOW RESOLUTIONS AND SMALL SIZES:
' A TYPICAL LOWERCASE a '
' A LUCIDA LOWERCASE a '

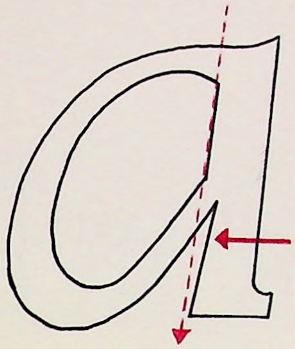
FIG: 15.

WEIGHT AND CONTRAST

The shade of gray that a text makes on a page is termed text colour. It describes the delicate balance of the black of the type itself against the white space in and around each letter. This colour can be light or dark depending on the contrast between the thicks and the thins of the individual characters. The thicks are the vertical stems, curved bowls and main diagonals, while the thins are the serifs, the hairlines and the joints.* High contrast faces appear delicate and brilliant to the eyes when read as sentences while low contrast faces appear stolid. A good text typeface must be a balance between the two. This is difficult enough to achieve at the best of times but when limited by low resolution it could appear as an almost impossible task.

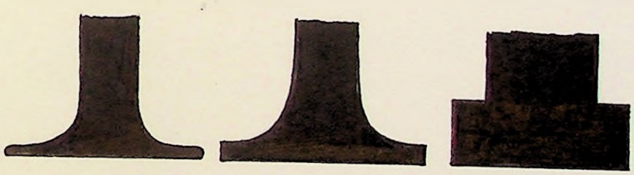
Because some laser printers erode letter contours Lucida hair lines and serifs are relatively thick to prevent breakage but at the same time Lucida's erosion resistant serifs were shortened to avoid darkening the text colour which would render it uninviting. This shows how a designer must always keep in mind what a relative character will look like in a text format / context as opposed to singled out on its own. In opposition to the erosion process Lucida has to simultaneously compensate the filling in nature of black printers. Filling in is a common problem in the joint of a character where a thick meets a thin.** The branching of this joint in all of Lucida's characters is relatively deep on the stems so that the triangular counter form has a generous area. Hence even when this counter is filled to some degree in smaller text sizes it remains open ensuring the appearance and character of the face are unaltered. After Ms. Holmes had designed this particular feature in

* See Figure 14
** See Figure 15



THE SLIGHT INWARD SLANT ON THE INSIDE OF THE LOWER HALF OF THE STEM IS AN ADDITIONAL PRECAUTION AGAINST CLOGGING AS IT ALLOWS FOR EVEN MORE WHITE SPACE IN THE TRIANGULAR AREA.

FIG : 16 .



. A FINE SERIF : . A BRACKETED SERIF : . A SLAB SERIF :

FIG: 17 A

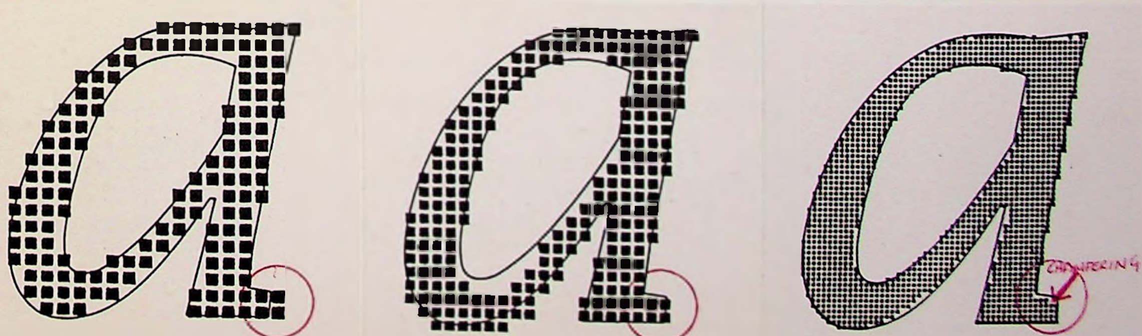


FIG : 17 B

Lucida she interestingly discovered that Fleishman, an 18th century punchcutter, had used a similar technique in his cutting of small sizes of metal type. To further prevent clogging she gradually reduced the thickness of the stem where it approached a joint.* In other words the stem cuts inwards at a slight angle. This alteration is virtually unnoticeable to the naked eye but it is an absolute necessity to avoid the filling in process.

SERIF SHAPES

Curved bracketed serifs are difficult to represent at low resolution, necessitating more time to scan and digitise and utilising more computer memory space to store. The simplified slab serifs are therefore obviously more economical and look acceptable at low resolution output.** However, at medium resolution ouput with its slightly finer rendering the slab serif appears coarse. Therefore Lucida's serifs were designed to compensate for both extremes by the chamfering of the serifs with slight diagonal taperings. At very low resolutions these serifs can be rounded off to simple slabs but at higher resolutions the chamferings provide variations in weight and thickness that enliven the printed texture.

X HEIGHT

The X height describes the apparent size of a typeface as opposed to its point size and is taken from the measurement of the height of the lowercase x in any given typeface.@ Most of the shape information in the lowercase alphabet is carried by those parts of the letter between the base line and the x line. Typefaces with

* See Figure 16
**See Figure 17 A AND 17 B
@ See Figure OVERLEAF:

FIG: 18.

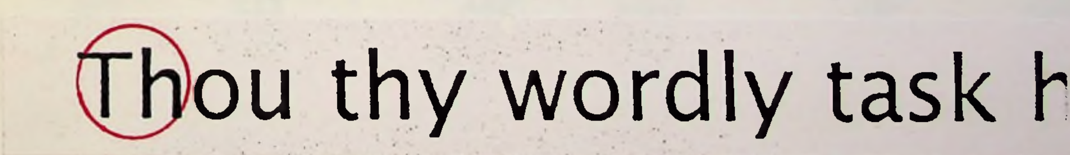


FIG: 19.

large x heights look bigger than those with small x heights even though the point size of both faces may be the same. Low resolution systems entice the designer towards large x heights because the complex middle portions i.e. between base line and x line, of the lowercase leters need more resolution than the relatively simple ascenders and descenders. However, if the ascenders and descenders are shortened too much, such letters as the lowercase g will look unnatural while the h, p and b will look indistinguishable from the other letters. Therefore there has to be an upper limitation on the x height. The x height of Lucida, because of its low resolution output, has to be big. This allows for more detail to be devoted to lowercase letter shapes. Lucida, at 9 point, looks like the 10 point or 11 point of other faces. It also allows for a slightly narrower character which in turn provides a compact and economical typeface that can pack a relatively large amount of legible text information into a relatively small area. This is particularly suitable in Lucida as it is mainly utilised in an office environment where voluminous amounts of data (reports, manuals, directories etc.) are printed.

CAPITALS

Documents printed on laser printers in an office situation are usually dominated by capital letters. Influenced by Griffo's design Kris Holmes made Lucida's capitals shorter than the ascenders of the lower case so that they would not appear too distracting when used extensively in text.* She also observed weight difference between capitals and lowercase letters which can often be exaggerated at low resolution where a one pixel increment difference in stem thickness can make a lot of difference in weight appearance, making capitals

*See Figure 19.

Fear no more the heat o' th' sun,
Nor the furious winter's rages;
Thou thy wordly task hast done,
Home art gone, and ta'en thy wages:
Golden lads and girls all must,
As chimney-sweepers, come to dust.

Lucida typeface specimens

FIG: 20:

seem much darker than other letters. The capitals in Lucida have therefore been designed to appear similar in weight to the lowercase letters to keep the alphabet harmonious at lower resolutions. De-emphasised capitals are often preferred in particular situations such as in business documents and in German language material which utilises a lot of them.

MODULARISATION

The sign of really good designers if their ability to design a whole type family derived from the principles of one face. Lucida exhibits a family that includes a serif and sans serif face in addition to bold versions of both of these as well as an italic face in both weights. This variation in styles is a necessity today as business documents are becoming more complex in this era of computer literacy. A single document may contain various texts and graphic elements such as titles, headlines, body text, captions, tables and indices as well as charts, graphs and illustrations. An integrated family of typefaces makes the designing of such a document an easier task for the office worker and offers a greater chance of producing a graphically unified result.* Where the Lucida family of typefaces really shows its strength is in its modularisation of design. This simply means that despite the vast variety of character styles across the family, all the individual characters can actually be represented in computer memory, as assemblages of component parts rather than separate letter e.g. the x height, capital height, ascender and descender lengths are aligned through the entire family. Weights are harmonised and design features are repeated. Modularisation more often than not is just a simple result of a precise understanding of the design parameters incurred by the

*See Figure 20

In every period there
have been better
or worse types

In every period there
have been better
or worse types

In every period there
have been better
or worse types

Three stages of designing showing chancery cursive

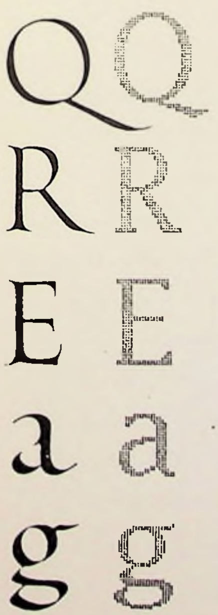


FIG: 21

system but it brings to light the necessity of understanding the production process and being able to design within its limitations to economically produce an aesthetically pleasing typeface.

Thus we can see from the design process of Lucida just how many limitations there are in designing for low resolution but how, despite these limitations, it is possible to design a perfectly legible and aesthetically pleasing face that can override the inadequacies of this system and utilise what it has to offer to its best advantage. But this can only be done if the designer has an adept knowledge of type, type traditions and the production procedure itself. Ms. Holmes's calligraphic training has contributed much to the success of Lucida as she has based the design very strongly on classical pen and brush written strokes which ensure a sense of familiarity and recognition of Lucida without it being a direct copy of any previous typeface and using these qualities has applied them successfully within the constraints of the medium.*

> "It was a huge, huge project. Really, if I had any idea how hard it was going to be I would have hesitated - and then done it because the challenge was too exciting not to try. The hardest part of any design is that you have to be two people, one who is the artist, the intuitive thinker, and the other who is the technician who can hold lots of numbers in her head and is always thinking down the line to the next phase and how the machine will distort the shapes. But I am also extremely proud of the results. We wanted Lucida to be a good strong face with no pretensions, an invisible face, and I think we accomplished that." Kris Holmes, January 1988**

* See Figure 21
**Ref Bibliography No 22

The history of typography displays an increasing amalgamation of typefaces into families: capitals ;

LOW RESOLUTION 'GLYPHA LIGHT' OUTPUT FROM A LAZER PRINTER:

Laser printers offer typographic variation intermediate between the simplicity of the typewriter, which may have one or a few faces available, and professional graphic arts typesetting, which offers thousands of different designs. The lucida family offers a carefully-tuned family of design variations, based on traditional forms, that provide the computer-age author and editor with a coherent and functional palette of typographic textures, optimised for legibility within the limitations of the medium.

LOW RESOLUTION 'TIMES' OUTPUT FROM A LAZER PRINTER....

Laser printers offer typographic variation intermediate between the simplicity of the typewriter, which may have one or a few faces available, and professional graphic arts typesetting, which offers thousands of different designs. The Lucida family offers a carefully-tuned family of design variations, based on traditional forms, that provide the computer-age author and editor with a coherent and functional palette of typographic textures, optimised for legibility within the limitations of the medium.

LOW RESOLUTION 'LUCIDA' OUTPUT FROM A LAZER PRINTER:

EXAMPLE OF HOW LUCIDA RETAINS ITS LEGIBILITY AT LOW RESOLUTION IN COMPARISON TO OTHER FACES :

Chapter VI

THE DESIGN AND PRODUCTION OF THE 'HIGH RESOLUTION' TYPEFACE ISADORA

- CONCEPT
- IMPLEMENTATION

Chapter VI

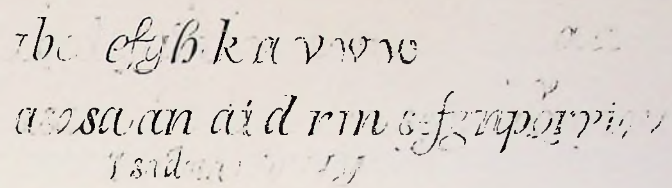
THE DESIGN AND PRODUCTION OF THE 'HIGH RESOLUTION' TYPEFACE ISADORA

In complete contrast to the limitations low resolution has on a design we can now see how high resolution allow for the most delicate and innovative offeatures to be displayed in type designs. This thesis will again examine the work of Kris Holmes to show how a designer can apply her/himself across the various resolution systems. Her typeface 'Isadora' was designed specifically for Dr. Rudolf Hell, a German manufacturer of high resolution digital composition equipment. According to Ms. Holmes "the amount of free form expression in a design often depends on its intended function. Types used for display can be wild but types used for text must be disciplined."* Isadora is primarily a display text and was inspired by a combination of her calligraphic training and, believe it or not, her interest in modern dance. Displayed in a resolution of more than 2000 lines per inch, Ms. Holmes had the freedom to make Isadora as delicate and complex as she wished stressing the contrast between fine hairlines and strong stems and indulging in exuberant swashes and joinery thus illustrating how the digital medium is capable of displaying the finest of details at high resolution despite its grid format.

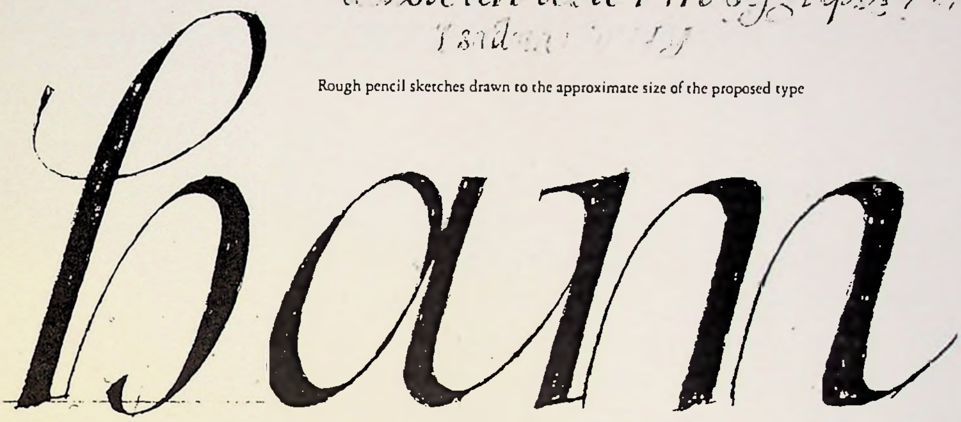
CONCEPT

In studying the manuals of the masters of the English round hand scripts Ms. Holmes came to admire greatly the work of Joseph Campion whose work dates from the mid eighteenth century. She was particularly enchanted by his occasional use of a double line in the

*Ref Bibliography No 19



Rough pencil sketches drawn to the approximate size of the proposed type



Enlargement of rough sketches to approximate Hell drawing size

FIG : 22

Original pencil drawings from the enlarged sketches

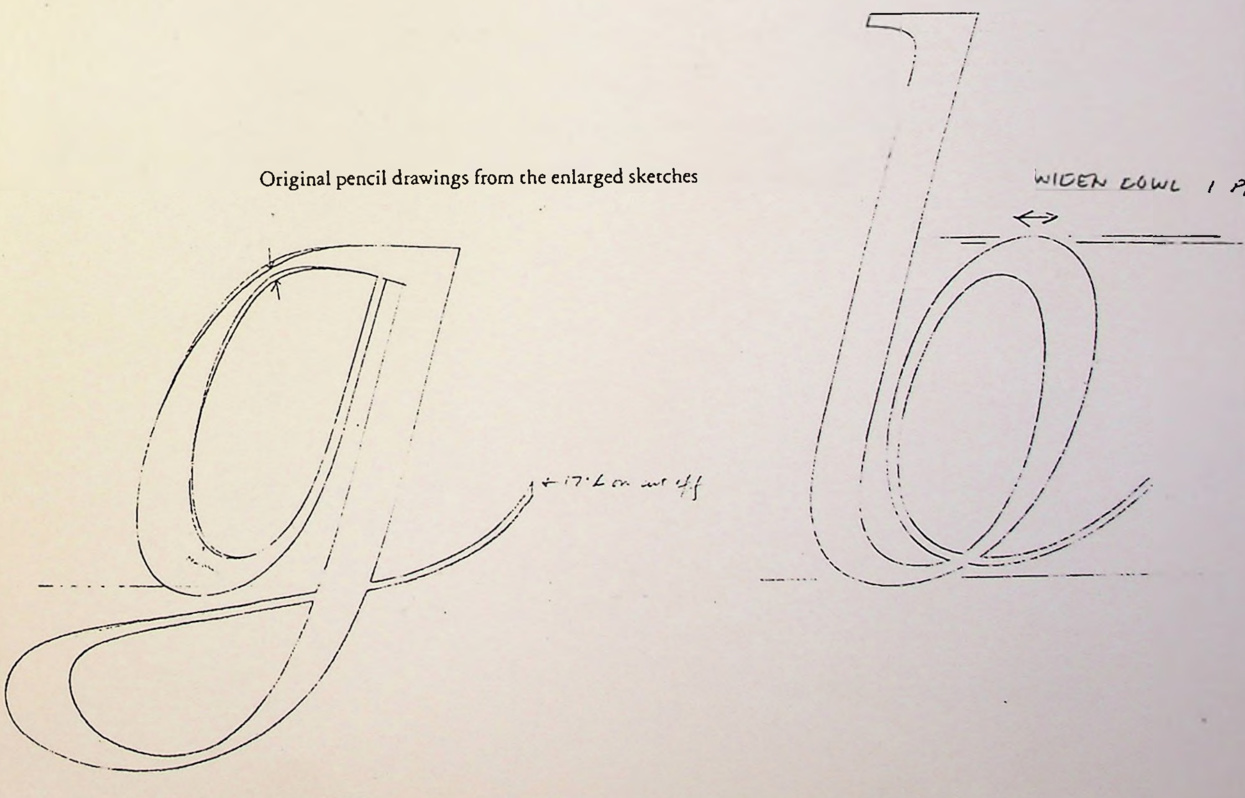


FIG 23.

stem of the lower case p. Realising the virtual non-existence of production limitations, Ms. Holmes considered this an appropriate starting point for a totally new design feeling that the contrast between thick stem and thin hairline across a line of text would create an engaging visual rhythm. The result was a modern design based on old principles yet it is not a direct imitation of any one historical script.*

IMPLEMENTATION

Ms. Holmes knew what she required of this design: a script big in body with a large x height and relatively short ascenders and descenders with classically proportioned capitals that compared well with the lowercase. This lowercase was to have a relatively simple joining scheme because according to Ms. Holmes herself the tracery of complicated joins can sometimes obscure the letterforms themselves. Digital typesetting shows its advantages here in its ability to provide extremely precise alignment and character overlap more so than any previous production procedure ie. mechanical composition or photocompostion. The initial concept was presented to Hell in keyword form namely the word 'Hamburgefon' which contains typical letterforms. This keyword is necessary as it saves the designer the trouble of drawing us designs for every character before the design itself has been resolved. After much examination she decided that the linkage system appeared monotonous and redesigned some letters to stand freely. When she was satisfied with her keyword characters Ms. Holmes photographically enlarged her drawings to approximately seven inches high, the size needed by Hell for the digitisation process.** Ms. Holmes states at this point

* See Figure 22:
**See Figure 23:

Bit maps showing the positions of the individual bits that constitute the character images of letters *g* and *b*

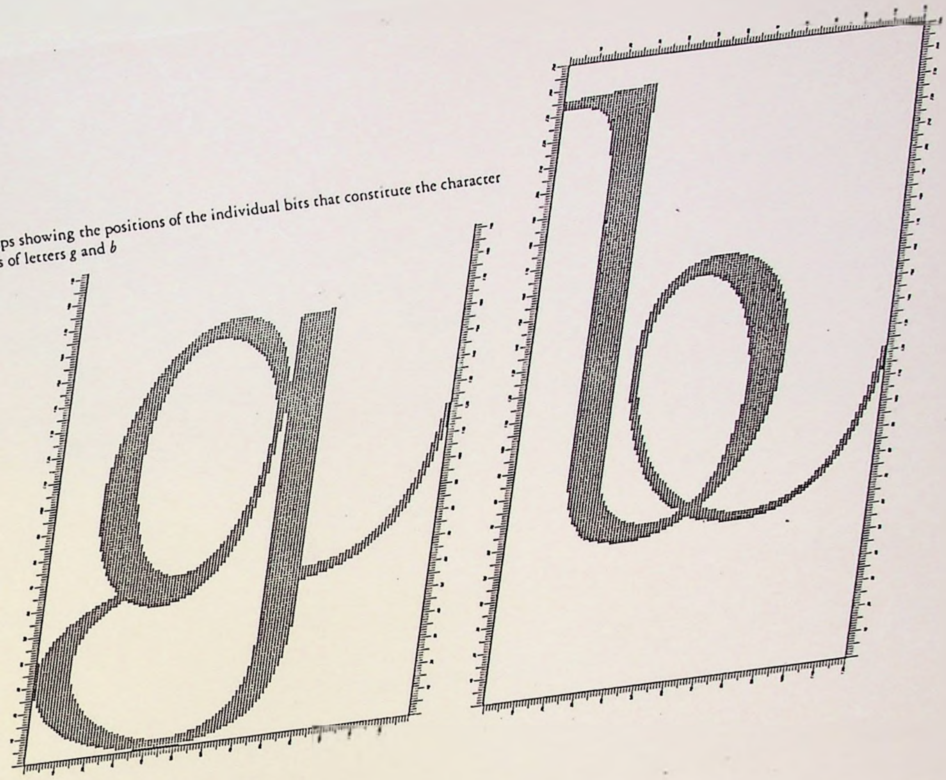


FIG: 24:

"I loved the texture and drama of those photo enlargements but was shocked when I laid the Hell digital grid on top of them and saw that my dance would have to be disciplined."*#

Even at this high resolution Ms. Holmes realised that hairlines would have to be thickened or they would disappear at 12pt and below. As in Lucida, the gap between the stems and the delicate joins would have to be widened when the two were parallel or they would fill in and coarsen the letter itself. The letter spacing and the letter joins would have to be co-ordinated so that the joins would connect properly in every combination. It is necessary to state here that these disciplines would have been necessary in any production procedure for such a delicately styled face but the main discipline came with the need for parameters within Isadora to make it work as a system of similar stems, bowls and hairline measures of precise alignments and parallelisms. In other words like the modification necessary in Lucida, Isadora too had to rationalise itself in order to allow the computer to easily convert the characters into bit maps of individual pixels or picture elements.

With all this in mind Ms. Holmes modified the keyword "Hamburgefons" extensively. It was then digitised again and proofed on a digital typesetter. Satisfied with her main character shapes so far, Ms. Holmes then launched herself into the task of designing the remaining letters of the alphabet as well as the capitals, lining figures, old style figures, punctuation marks, foreign accents, ligatures, dipthongs and assorted signs and symbols. In all a vast 146 characters. These designs were then processed into digitised characters at Hell and arranged into a body of text. This procedure according to Ms. Holmes is the ultimate test of a type design, as it is here that any remaining flaws or weaknesses in a typeface,

*See Figure 24:
#Ref Bibliography No 21

Schriften ändern sich in ihrem Stil mit der Zeit und der Technik. Nicht nur die Technik der Schriftschöpfer, sondern auch die der Setz- und Druckmaschinen beeinflußt das Aussehen der Schrift. So ist es auch heute im Lichtsatz. Der Digiset setzt seine Schriftzeichen aus vielen kleinen Lichtlinien zusammen. Dabei entwickelt der Kathodenstrahl seine eigenen Gesetzmäßigkeiten, wie sie bei jedem technischen Vorgang auftreten. Wir überlassen die Gestaltung eines Zeichens nicht dem Zufall der linienweisen Aufzeichnung. Besonderheiten der Auflösung und des runden Lichtpunktes

nen Lichtlinien zusammen. Dabei entwickelt der Kathodenstrahl seine eigenen Gesetzmäßigkeiten, wie sie bei jedem technischen Vorgang auftreten. Wir überlassen die Gestaltung eines Zeichens

Setz- und Druckmaschinen beeinflußt das Aussehen der Schrift. So ist es auch heute im Lichtsatz. Der Digiset setzt seine Schriftzei-

Specimens of Isadora in 16-point, 24-point, and 28-point sizes

FIG : 25.

untraceable at previous stages in the design, show themselves. Ms. Holmes states how

> "some letters refused to join; some were too fat, others too weak; some were wildly waving to everyone while others were plodden and sullen".*

This reminds us once again how testing for the modern designer is a necessity all the way through the designing process not just in low resolution but in all resolutions so that the designer himself will not be too suprised when he sees the finished printout. Therefore the more the designer understands the production procedure the easier his/her design task will be. The two constraints Kris Holmes faced with this particular typeface design were not really production constraints but more the rules and regulations that apply to the making of a good flowing and legible typeface.

> "I had striven to keep their individual spirits alive, but now I would have to drill them into a working troope - until the letters step by step relinquished their individuality and began to form words and the words became lines and the lines pages and throughout them all was a pattern, a texture, a theme that I had glimpsed so long before but could now at last see clearly. And so could anyone, for it was now a typeface and no longer a vision."*#

*Ref Bibliography No 21
#See Figure 25

And so we see how visions as ornate and intricate as Isadora can actually be realised in the digital medium where high resolution is able to produce the finest of hairlines and the most elegant italics impossible at lower resolutions or even other media.

CONCLUSION

A QUESTION OF TRADITION
Monotype
The Adaptation of 'Times'
Innovation versus Imitation
Integration Between Designer and Technician

CONCLUSION

It appears we are in the midst of a major transition with regard to type production. This is not just a transition of procedure but a transition that has changed the analogue quality of our typefaces to the coded language of a computer program. No longer is it enough to know about just typography but we must also be very knowledgeable about the system that has produced it in order to ensure quality across the whole range of resolution output.

A QUESTION OF TRADITION

Chapter II discussed the question of whether this new industry had affected the shape of out traditional letters. It appears that, for the best part, it has not, as medium to high resolution allows for faithful reproduction in digitised form the traditional analogue faces with which we are familiar. But the industry is, however, operating at two extremes because at the low resolution end of production it is impossible to apply the logistics of type design normally applicable to high resolution output due to the technicall inadequacies of this less expensive system. So at one end of the scale we have perfact reproductions of our traditional faces while at the other these same faces appear crude and often illegible. The problem therefore appears to be a technical one and one which will surely be overcome in due course allowing, as a result, high resolution systems to be installed in the office environment as well as in the professional typesetting field. But in the meantime technical limitations are no excuse for bad design in low resolution and to overcome this the question of tradition must be examined.

TimesRoman 8

TimesRoman 10

TimesRoman 12

FIG 26 A:

RQENbaegn

Times Roman. *By Stanley Morison and Victor Lardent, for The Times of London, 1931. One of the most popular type faces of all time, in many respects it is a reworking of Plantin 110, with a larger x-height, thinner serifs and hairlines, and narrower proportions, but some resemblance can still be seen to Granjon's Gros Cicero.*

FIG 26 B:

MONOTYPE

In this particular area of type design for digital output this thesis attempts to identify extremities of opinion that exist with regard to the question of 'tradition'. The first is put forward by the Monotype Corporation in Surrey, England who have a long established reputation of producing good typeface designs for nearly a century. Their approach to the present transition from analogue to digital type therefore rests largely on this tradition. Although completely up to date with the latest technology, Monotype believe that the production procedures should not inhibit the designer and that is is their job to reproduce by whatever means possible a given type design. Their aim is therefore to adapt already well established analogue designs to this new system believing that the existing pedigree of a given typeface is a definite assurance of quality. According to Professor Charles Bigelow it is true that "a new technology must imitate the forms of previous technologies because of reader conservatism but at the same time such imitation leads to problems of inferior quality in production."*

THE ADAPTATION OF TIMES

To understand fully how adaptation of traditional faces or analogue faces falls short in low resolution output let us examine the popular typeface 'Times' to see just how its legibility is adversely effected. As we can see in the illustration** the thin serifs and hairlines have thickened which destroys the elegance and brilliance of the face. The carefully tuned letter proportions of the face have been coerced into a digital unit system. The x height, capital height ascender and descender lengths have all been made to fit into

* Ref Bibliography No 13
**See Figure 26 A

this grid format with the result that the proportions vary noticeably from the original. Character and original design have been filtered out and what remains is unfortunately not Times but a generic set of features that could in fact belong to any of several designs.

INNOVATION VERSUS IMITATION

The solution to this problem therefore is not to adapt but to recreate utilising this generic information. It may mean less of a range of designs to choose from in the low resolution range but at least those that do exist will be of a reputable quality because by redesigning rather than adapting we are achieving optimum quality within the constraints and limiations of the medium. This is the approach to tradition that is represented by the other strain of thought by the aforementioned company of Bigelow & Holmes of San Francisco. The designers and producers of the first typeface, Lucida, for low resolution laser printers, they are therefore very familiar with the problems incurred in this area of low resolution designs. They believe in the superiority of original designs rather than adaptations for coarse digital output and they quote the twentieth century Dutch designer Jan Van Krimpen as saying "are our hearts and our minds really so poor that we cannot do better than copy and adapt: and are not our copies and adaptations doomed to be and to remain hybrids".*

They "are not in favour of converting faces from one technology to another" believing that "new technology in its nature demand new designs".**

* Ref Bibliography No 20

**Ref Bibliography No 22

However this does not mean that Bigelow and Holmes innovate from nothing! As we have seen in Chapter V with their typeface Lucida their designs are well founded on traditional principles but like most designers they have the added advantage of being completely knowledgable of the constraints and the limitations low resolution imposes on the designer and can as a result implement these traditional principles within those constraints. Charles Bigelow, in his studies, has summed up the situation by stating that "the history of typography can be viewed as a series of successive adaptations to new technologies"* as we saw in Chapter I i.e. punchcutting to photocompostion to the present form of digitisation. Professor Bigelow believes that in each of these transitions there have been some ways in which the new technology always "appears inferior to the old as well as providing new possibilities".* He describes how time and time again designers strive to emulate the old which involves compromises and produces results which fall short of the model being emulated. But as time passes and people become more familiar with the new system they then begin to design within its limitations taking advantage of its full potential as Lucida has done.

Thus we see how innovation necessitates the designers complete understanding of the restraints of the medium. Low resolution in digitisation is going to remain a limitation until technology provides a solution. In the meantime the designer must compromise by designing within these limitations utilising the basic fundamental principles of type design with regard to legibility and the generic information we saw with Times. This generic information is necessary to represent traditon and therefore ensures recognition and acceptance. The users of low resolution output systems also need to realise that the 'name' of a typeface is not an automatic

* Ref Bibliography No 15

guarantee of quality across a range of resolutions. It is natural for people to be wary of new typeface designs preferring to stick with a well established and familiar face. However typefaces that are badly adapted are much more susceptible to criticism than those that have nothing specific against which they can be compared!

INTEGRATION BETWEEN DESIGNER AND TECHNICIAN

As we can see the Monotype Corporation and the parternship of Bigelow & Holmes are two extremes. Kris Holmes and Charles Bigelow, being a small company, can work in conjunction with the computer equipment at all times. Monotype, on the other hand, are a very large corporation where design and prouction are undertaken by various different people. There is the design section, the drawing office and the production office. As we have already witnessed the adaptation of traditional analogue forms is alright in medium to high resolution but the task of designing specific new faces for low resolution is immense requiring a comprehensive knowledge not only of type design but of the production procedure itself. The problem in Monotype, which is a problem in most large type design corporations today, is that design and production are undertaken by two separate people, a designer and a technician. Obviously it is difficult to acquire designers who are adept technicians and virtually impossible to acquire technicians who just happen to be designers. Therefore integration is a necessity to achieve good results especially at low resolution output. Monotype are presently trying to integrate their procedure but it cannot be done overnight and will take time. Submission of designs for low resolution output is virtually impossible from freelance designers as they design on a correspondence basis and will not be in contact with the equipment or the process involved in utilising it.

Thus we see how it is impossible to design just for medium of and high resolution and ignore the problems of low resolution by simply implementing the rules of the former across the board. To tackle the problem requires first and foremost the responsibility of a completely differecnt approach requiring more attention from the designer in order to compensate for the technical limitations. This may well be considered a major invonvenience by the type production industry but the extra knowledge that is required of the designer and the production technician, be they the same or individual persons, can only ensure a better quality of type design and production across the whole range of outputting systems.

For the first time in centuries we have developed a system that can produce at one end of the scale more perfect reproductions of type than ever before while simultaneously at the other end of the scale production is crude. Ironically, never before has type design been restricted as much as it presently is in this low resoltion area. Type designs have been handed down to us over the centuries. They are designs we are familiar with and recognise easily, therefore, although they cannot afford to change drastically overnight to accommodate this low resolution area, they also cannot be satisfactorily transferred with this new technology. Therefore, we must redress the fundamental principles of type design while keeping in mind the traditional features with which we are familiar. This information must be utilised within the limitations of this system. The result is not completely innovative but neither is it sheer imitation.

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GLOSSARY

BITMAP:
A way of specifying whether each pixel on a grid is on or off. Usually thought of as a piece of graph paper on which each square is either all black or all white.

BOWL:
The curved part of the letters B, P, R, b, d, p and q and the lower secion of the letter a.

CATHODE RAY TUBE (C.R.T.):
The electronic device in some high speed machines which transmits the letter images, formed of lines or dots, on to the output film or paper.

COLOUR:
The term used to describe the tone of a type in mass on a page.

COUNTERS:
The white areas enclosed within characters e.g. the eye of e and the two interior spaces in B. Also used to refer to the space between the upright of a letter e.g. H and n.

DIGITISING:
The process of converting the contour of a character, or the whole of it, into coded data for storage in a computer memory.

FRISKET:
An enlarged type character that has been cut from a piece of transparent red laminate so that it can serve as a ready made negative/artwork in the digitising process. Most current type designs exist in master form as friskets.

INTAGLIO:
Term used to describe an incised or engraved surface as opposed to relief.

JAGGIES:
A visible stairstepping effect on the edge of a digitised curve or line. Most noticeable at angles near horizontal or vertical.

MATRICE:
A piece of brass or copper into which a character has been stamped or engraved and from which type can be cast.

PHOTOCOMPOSTION:
A typesetting device consisting of a lens system, a light source, a font of characters in the form of a disc or film strip negative and a means of selecting a character from it.

PIXELS:
Picture elements; the 'atoms' into which the digitised process converts a character.

PROGRAM:
The set of instructions in a computer which it carries out in sequence.

RESOLUTION:
The coarseness of the grid of pixels from a digital output device, measured in either pixels (dots) or lines per inch. Below 300 lpi is considered low resolution, 300 - 800 medium resolution and above 800 high resolution.

RUBYLITH:
The transparent red laminate material used to make friskets or character masters for the digitising process.

X HEIGHT:
The distance between the baseline and the x line i.e. the distance from the base of the lowercase x to the top of the lowercase x. Used to describe appearing size of a typeface.