Chapter 1 Type and Typography

Chapter 2 Typographic Procedures, Rules, and Niceties

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One

TYPOGRAPHIC

METHODS AND

PROCEDURES
Type and Typography

Type is the heart of most visually conveyed communication. Despite the rapid technological changes that occur on an almost daily basis, our understanding of type and our comprehension of the information that it conveys remain constant. Reading remains the one computer skill that is unlikely to change.

The proper use of type can help to communicate a message by attracting readers—making the reading experience more enjoyable by making it more attractive, more organized, and more comprehensible. Despite changes in technology, the use of type and the representation of the alphabet have been a constant element in the recorded history of mankind.
Typewritten versus Typeset

As late as the mid-1980s, most computer installations that provided some word-processing capability usually offered two forms of printed output: dot-matrix and letter-quality characters (Figure 1.1). Both varieties of printer were engineered to produce output that conformed to requirements for standard office documents. These document types included such categories as work drafts, reports, tabular matter, and, depending upon the quality level of the character forms, correspondence.

Correspondence quality became a default standard for evaluating the quality of line-printer output during the early days of personal computing. This “standard,” which has never been formally defined, is nothing more than an objective measure of how well the line printer produced characters similar to those of a typical office typewriter. Thus, instead of computer technology providing better-appearing output than had been available in the home and office, the goal became the imitation of standard typewriter output.

The idea for the typewriter, which continues to influence business communication today, was first stated in 1714 by Henry Mill. Mill, an Englishman, received a patent for a machine that he described as “an artificial machine or method for impressing or transcribing of letters, singly or progressively, one after another as in writing, whereby all writings whatsoever may be engrossed in paper or parchment so neat and exact as not to be distinguished from print.” Mill’s machine failed; however, his idea obviously did not. In 1867, C. Sholes and Samuel W. Soule, printers in Milwaukee, and their associate, Carlos Glidden, continued development of what would become known as the typewriter. By 1873, they had completed a practical working model, which was manufactured shortly thereafter by E. Remington and Sons of Ilion, New York. The acceptance of the machine by business and industry stimulated other inventors to produce similar machines. By 1886 there were more than 50,000 typewriters in use.

Ironically, the typewriter was invented to imitate printers’ type, and the earliest typewriters actually used pieces of metal type mounted on the typebars. The typewriter, while providing only a coarse typographic image, did serve to automate the handwriting process, and by so doing, to change the way in which offices conducted business (Figure 1.2).

2. Ibid.
Chapter one

Type and Typography

With any other metal typeface previously issued. According to one account, the design was suggested by a stationer from Huntingdon, Pennsylvania, named J. C. Blair, who was reputedly a typographic expert. The typeface was sold with the intention that "circulars could be made to resemble genuine correspondence, and thus secure for them the attention which it was previously so hard to get." By the turn of the century, nearly every type foundry had a similar design in its specimen book. Quite ironically, the typewriter, which had been invented to simulate printing, was universally being simulated in print (Figure 1.3). Today, most typesetting machine vendors, page-printer manufacturers, and type library publishers still offer one or more typefaces that resemble typewritten characters. It is for this reason that Courier is among the most commonly used type designs in the world.

The coarse, misaligned, and handcrafted look of typewriter fonts has influenced the "grunge type" movement of the 1990s, which consists of designs that are anti-establishment, anti-convention, and anti-uniformity. Grunge typeface appear to represent a disregard for tradition, order, and most of all, legibility. They have been termed "subjective typography" since their forms and designs convey a meaning beyond the words that they represent:

FIGURE 1.3
Typewriter typefaces from the 1923 edition of the American Type Founders (ATF) specimen book.


4. See Appendix A for contact information.
for use on the mimeograph machine. The major typesetting alternatives of the day were the hot-metal linecasting machines, such as the Linotype and Intertype, and the more complicated character caster, the Monotype. These machines were too large, sophisticated, and expensive to meet the needs of an office reproduction department, so the typewriter, having undergone considerable improvements in construction and capabilities since its introduction, became an office typesetter.

A number of machines were introduced that were much more than ordinary typewriters, yet much less than typical typesetters. The IBM Executive Typewriter provided proportionally spaced characters, while the Friden Justowriter offered justified output (i.e., text aligned at both the left- and right-hand margins) and paper-tape storage. The VariTyper was one of the first typewriter-like machines specifically made for typesetting applications (Figure 1.4). It remained in a class by itself until 1967, when the IBM Selectric Composer was introduced.

These specialized machines, which provided limited typographic capabilities, became known as direct impression, or strike-on, typesetters. Many people referred to their output as cold type (as contrasted with hot-metal typesetting), and the term has been used loosely—and erroneously—to describe any typesetting method that does not involve the casting of molten metal.

As the offset printing process replaced or augmented other forms of office reproduction, the strike-on method of typesetting grew in popularity. Unlike ordinary carbon-ribbon typewriters, strike-on machines produced sharp, dense (black), proportionally spaced characters suitable for graphic reproduction.

By the end of the 1980s, the long reliance on the typewriter to generate office documents resulted in the emergence of what was termed office-quality reproduction. This level of quality can be defined as “monospaced typewritten characters of a single style and size, appearing in single- or double-spaced line format, in either justified or unjustified mode, and usually occupying a standard 8.5 × 11-inch sheet.” Many of these attributes were virtually unchanged from those achieved on the earliest typewriters, despite the computer-processing power and output options that were readily available and capable of supporting much more sophisticated typographic treatment.

Today, some businesses remain tied to the typewritten tradition that can be broken easily with inexpensive desktop publishing tools and some basic typesetting, design, and layout skills.
THE TYPEDWRITTEN LEGACY: 
WHY TYPESET?

The outputting of typographic composition and page elements—commonly called imagesetting, in the professional context, and desktop publishing, in the general context—provides many more advantages than simply a better appearance than typewritten output. Yet, appearance is, perhaps, the major factor in opting for typesetting. There are literally tens of thousands of typeface choices suited to a wide variety of specialized uses and to convey almost any feeling or mood. Consider the lightly flowing script typeface on an elegant menu, or the bold, commanding typeface in a truck advertisement. The selection of an appropriate typeface is very important in communicating a message (Figure 1.5). (The process of making that choice will be examined later.)

The use of appropriate typefaces, properly composed, not only helps to communicate, but also adds an element of prestige to printed material. The image that a company, or an individual, projects is enhanced by good typography, and this increased attractiveness helps to catch and hold the reader’s eye. Getting and maintaining the reader’s attention is critical for effective communication because the message that will be read is the one which has more visual appeal (Figure 1.6).

While a difference in type style helps to attract the reader’s eye, it is the difference in type size that helps to

\[\text{FIGURE 1.5} \]
The proper selection of a typeface reinforces a message by providing a visual structure for information content. To get an idea of how important type selection is, imagine if we were to reverse the font selection on the specimens below.

\[\text{FIGURE 1.6} \]
This 1970s Varityper advertisement compares the effectiveness of phototypesetting over typewriting.
organize information in terms of its relative importance. Typewritten text is all the same size, despite the fact that all of the information it represents is not necessarily of the same factual value. While the content display for typewritten text has very little flexibility other than capitalization, underlining, changing from double space to single space, or changing the margins, typeset output has much flexibility in displaying pieces of information according to their relative importance. This capability makes it easier for the reader to locate the information that the message’s originator considers most important.

Some of the most compelling reasons for many businesses to choose typeset output are purely economic considerations. Typesetting provides increased character density. While typewritten characters are usually limited to 12 characters per linear inch, typeset characters can be from 50% to over 200% denser in terms of their compactness on the line. Combine this increased density with the capability of minutely controlling the vertical spacing of lines, and typeset matter can easily transmit more information in a given space than typewritten matter (Figure 1.7) and without sacrificing readability. Estimates of this space-saving factor range from 40% to about 60%, depending upon the type sizes and styles involved.

Just as microfilm dramatically reduces the bulk of paper records, the process of converting information into typeset form has a similar positive effect on reducing paper bulk. It is this reduction in the space that information needs to occupy which provides economic benefits for users of typesetting technology, such as digital publishers. Reduced space requirements mean less paper to buy, less paper to handle, less paper to distribute (mail), and less paper to store. Not only are significant dollar savings possible, but the reduction in handling time means that information can move faster and more efficiently. In addition, well-designed and composed documents can be maintained in electronic form, to be delivered and read on- or offline, and printed on-demand when needed.

Even when substituting a computer screen for paper, there are several common advantages. Although designing for the screen has its own design considerations, the use of properly executed typographic elements increases both the aesthetic and communication value of the message.

The equipment used to produce typeset output does not need to be on-site or in-house in order to realize its major benefits since typesetting and design services can be out-sourced. However, when the entire typesetting operation is captive within a company, it provides significant additional benefits as compared with having typesetting performed by an outside vendor, such as a service bureau. Attractively priced, high-resolution page printers make in-house output affordable for almost every business. The most immediate benefit of having the output equipment on-site is that of control. The typesetting personnel are now company personnel, and the production equipment now serves only one client. Information is typeset according to company needs and priorities; and sensitive, confidential, or valuable company data never leaves the premises. With fewer, and only company, people involved in the process, company data is more secure.

Having typesetting equipment located within a company also provides increased convenience. The problems of communicating information over telephone lines or the Internet, or sending media to an outside source, are eliminated. Turnaround time is reduced because there is no need to wait for messengers, spend time seeking sources of supply, or explain over the telephone how the job should have looked. Last-minute changes are handled according to priorities set internally, without delay or financial penalty.

**FIGURE 1.7**

Compare the typewritten specimen on the top with the typeset specimen on the bottom. Not only is the typeset information easier to read, but it also makes more efficient use of space.

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**TABLE 1.1**

Most contemporary typesetting keyboards are highly reliable, with error rates not usually exceeding 1 in 30,000 keystrokes. People, however, are usually less reliable. It is human error which most directly affects the highest attainable level of quality in any typesetting system. Studies have shown that the average human error rate is, at best, in the range of 1 to 10 errors per 6000 keystrokes.

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<thead>
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<th>TYPESET</th>
</tr>
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</table>

**TYPOGRAPHY: THE ART OF TYPESETTING**

*Typography* is the process of selecting typefaces, sizes, and spacing requirements for the display and layout of a message (printed piece, web page, multimedia screen, etc.). It is a process that requires considerable care and attention because actual harm might be done to a message by careless and inappropriate typographic decisions.
Typesetting has its roots in metal. The earliest metal type used in Western civilization was cast by Johannes Gutenberg in the fifteenth century. Prior to that time entire book pages had been carved in wood, a very slow and exacting craft that left no margin for error. Gutenberg’s invention of a handheld mold to cast identical character images made the mass production of type a reality. Not only could pages of type be assembled faster, but the type could be used again and again (Figure 1.8).5

Much of the terminology used today in typesetting is derived from the use of metal type. Many of the terms used to describe each piece of metal are human descriptors (face, feet, shoulder, body), as is type’s overall label of “character” (Figure 1.9). Type has been given many human qualities over the centuries, both in prose and in poetry, to provide testimony to its contribution to mankind.

**Point Size**

The point size of the type is determined by measuring the height of the type body (Figure 1.9a). Since the typeface design is limited to the physical dimensions of the type surface, the point size appearing in print (be it a metal impression, a phototypeset or page printer letter, or other) is found by measuring the distance from the uppermost limit of an upward-reaching letter (an ascender), such as b, d, f, h, l, or t, to the lowermost limit of a downward-projecting letter (a descender), such as g, j, p, q, or y.

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Relative Units

When all of the characters in use have identical widths, such as in typewriting, calculating the number of characters that will fill a line is easy. However, when characters of various widths, various designs, and various sizes will occupy a line, calculating characters per line is a much more difficult task. For this purpose, the em of each typeface design is divided into a number of vertical slices called *relative units* (RU). There are usually no fewer than 18 relative units to the em, and on more sophisticated typesetting machines, the number might surpass 100 units. PostScript and TrueType technologies, which are current standards, are based on systems of 1,000 or more units to the em.

When a 48-point em and a 72-point em have been divided into 54 relative units (Figure 1.11), we say that we are working with a 54-unit system. The widest characters—such as the $W$, the fractions, and the copyright and trademark symbols—are each assigned the full 54-unit value. The comma, the narrowest character, receives a unit assignment of 12. All other characters receive a unit assignment directly related to their relative width. The $G$ is equal to 42, the $v$ receives 27, and the $f$ gets 18.

Notice that each particular character listed in Figure 1.11 has the same unit value, regardless of its point size. In other words, a lowercase $g$ has a unit value of 30 regardless of whether it is in reference to a 48-point em, a 72-point em, or an em of any other size. Yet, comparing the relative width of a 48-point $g$ with that of a 72-point $g$, it is obvious that they are not the same size, which is where the *relative* part of the term *relative unit* assumes real meaning. In 48-point type, the $g$’s relative unit value of 30 is $30/54$ of 48, or about 27 linear points. In 72-point type, the $g$’s relative unit value remains 30, or $30/54$ of the 72-point em. In this case the $g$ has a value of approximately 40 points.

These ideas should be kept in mind when reading the next section about the typographic measurement system. Knowledge of relative units and typographic measurements will be combined to show how to determine the number of characters that can fill each line.

**TYPOGRAPHY: TYPOGRAPHIC MEASUREMENT**

Although most people recognize that type is measured in points, few actually know how large a point is. There are 72 points to the inch, each point being equal to 0.0138 inch. Type sizes (Figure 1.12) in the 9- to 12-point range are typically used for reading matter and are classified as *text sizes*. Type sizes of 14 points and larger are normally used for headlines (heads) and subheadlines (subheads) and are classified as *display sizes*.

**FIGURE 1.11**

To determine numerical values for each character of a type style, the em space is divided into vertical divisions called *relative units*, which are assigned to characters on the basis of their widths.

**FIGURE 1.12**

Size is an effective method for indicating relative importance and organizing information for the reader.

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For the First Time in Our History!  
100% American Made  
With Full Manufacturer’s Warranty  
Top of the Line Models  
Formerly Sold for Twice the Price  
Thousands Sold Nationwide  
Available for the Next 2 Days Only  
Over the Counter Replacement for 30 Days
Pica Units

Page dimensions, column widths, and line lengths are measured in larger units called picas. There are 6 picas in 1 inch, and 12 points in 1 pica (resulting in 72 points in 1 inch). The length of a line of type is called the measure, and is sometimes indicated by a multiplication symbol meaning “by”, as in ×24, or a delta (Δ24), and meaning a line length of 24 picas.

Line Measurement

The typeset line measure is comparable to the typewritten line width; the major difference is the difficulty in determining how many characters of a certain typeface will fill a typeset line. On a standard typewriter, there are either 10 characters to the inch (pica) or 12 characters to the inch (elite). In a typographic system, any one of thousands of different type designs might be in place, in any one of dozens, or possibly hundreds, of different sizes. To cope with this problem of estimating how many characters will fit on one line—called copyfitting (see page 73)—and how many lines (or possibly pages) will be needed, typesetters use a measurement called the character count.

The Size of a Word

Copyfitting calculations always take into account an allowance for word spaces. As a general rule, the typical word length is considered to be five characters. Because each word must be followed by a space, the copyfitting estimate for the average word length is then six characters. If the total number of characters in a document is known, an approximation of the number of words can be derived by dividing the total by 6.

Em Measurement

When type was set using metal characters, the sizes of the spaces were fixed fractional divisions of the em space. The em itself served as a spacing unit, usually for indentation at the beginning of paragraphs or to fill out short lines. The em was divided in half vertically to form two en spaces, also used for indenting, and since it had the same width as the figures, for setting (aligning) columns of numbers as well. In Figure 1.13, a line of metal type illustrates the height relationship between the spaces and the characters. Spaces, which do not print, are considerably shorter than characters. The amount of indentation is based upon tradition and is directly related to the length of the line measure.

The en space is too wide to serve as a normal space between words, so the em space is further divided into three vertical divisions, the 3-to-em, or 3-em, spaces. The 3-em space is the normal space used between words. The em space is further divided into increments of four (4-em) and five (5-em) to provide additional spacing options (Figure 1.14).

Typography: The Use of Space

It is the control of space that determines, in many instances, the quality of the typesetting. Take, for example, the problem of justification. Justification is the process of adjusting the space between words (and sometimes characters) to force a line of type to completely fill its line measure. Accomplishing justification on an ordinary typewriter is quite simple. First, the copy is typed, with attention given to the amount of space remaining at the end of each line.

FIGURE 1.13
In hand composition, pieces of metal type are assembled in a shallow handheld tray called a composing stick. After lines of type are spaced either out or in to fit snugly within the line measure, a thin (2-point) strip of lead is inserted to separate the lines. These strips are called leads, and the space between the lines of type is called leading. If no leads are inserted, the lines are said to be set solid. Thicker (6-point) strips of metal, called slugs, are used when 6 points or more of leading are required.
In the example shown here (Figure 1.15), x’s have been used to indicate the amount of excess space remaining. When the copy is retyped, the excess space is distributed between words to space out the line and fill the measure.

**Justification**

Justifying metal type is also a two-step process. First the line is assembled using 3-em spaces between words. As the end of the line approaches, it becomes obvious to the compositor (the person setting the type) whether the last word will leave the line short, will need to be hyphenated, will need to be carried to the next line, or would fit if there were slightly more space. The decision then becomes whether to expand (space out) the line to fill the measure, in which case minute increments of space made of slivers of copper, brass, and paper are added to the 3-em spaces; or whether to contract (space in) the line to make room for the last word, in which case some or all of the 3-em spaces are replaced by smaller spaces, or multiple pieces of spacing material.

Today this decision-making process is carried on in an electronic form by desktop computers. Recall that each character has a unit assignment based on its width, and that the unit system is devised by the manufacturer of the typesetting equipment (or the publisher of the digital type) with X number of units to the em. Remember, too, that the specific unit assignments vary from one typeface design to another.

The process can best be explained by describing how a traditional typesetting machine performs its calculations. The typesetting machine stores within its memory a table of width values for each typeface it is using. When a line measure is specified, the typesetter converts that number into em units, for internal calculation. For example, the line measure might be 18 picas and the type size might be 10-point. First, the machine determines how many 10-point ems will fit in an 18-pica line measure. Remember that an em is the square of the point size, so each 10-point em requires 10 linear points. To divide the line measure by 10 points, the line measure must first be converted from picas to points. There are 12 points in each pica; therefore, the 18-pica measure is equal to 216 points. Dividing the 216 points by the 10-point em yields 21.6 ems per line. Second, the
machine multiplies the ems per line by its units-per-em value. For this example, a 36-unit system is being used; therefore, there are 36 units in one em, and there are 777.6 units (21.6 ems × 36 units/em) in a single line that is 18 picas wide and composed of 10-point characters.

As each 10-point character is processed, its unit value is subtracted from 777.6. The minimum and maximum word spaces are assigned fixed unit values as well, with the minimum unit value being used for initial calculations. As the end of the line approaches (the justification or hot zone), the machine’s logic determines if there is enough room for part or all of the next word. If the word or partial word fits, its unit value is subtracted; if it does not, it is carried to the next line. The excess units remaining at the end of the line are equally divided among the word spaces, which then expand to fill the line measure (Figure 1.16).

The process that takes place on a typewriter is considerably more unrefined in its execution of interword space allotment. In most cases the characters are monospaced, and the spaces used to justify lines are multiples of the fixed character width. Justifying spaces are therefore either as wide as any character or two or more times as wide. This process makes for loose-fitting lines.

Returning to the justification example, what if the total unit count of characters and spaces equals exactly 777.6? If this were to happen, the line would be set with minimum-width word spaces. This is perhaps the ideal situation, since tight (close-fitting) word spaces are preferable for increased ease in reading. However, what if the opposite were to happen, wherein there was either considerable space left at the end of the line, or so few spaces in the line that they quickly reached their maximum allowable expansion? What would become of the remaining space?

The usual solution is to add small increments of space between characters in a process called letterspacing. Letterspacing is not considered good typographic practice because it pulls words apart, making them less recognizable as patterns for the reader’s eye (Figure 1.17). Letterspacing has no place in the typewriter environment since the size of a space is usually no smaller than the width of the average character.

Although justification is a very common way of orienting lines of type, it is by no means the only way. Lines can be centered (quad center), wherein the remaining space

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**FIGURE 1.16**
The process of electronic machine justification involves (1) converting the line measure into points; (2) calculating the number of ems of the point size that will fit on the line; (3) calculating how many units of space the line measure represents; (4) subtracting the unit width of each character and space that will fit on the line; and (5) distributing the remaining units among the word spaces to expand the line to fill the measure.

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**FIGURE 1.17**
Compare the properly spaced lines in the paragraph on the left with the excessively letter- and word-spaced lines in the paragraph on the right. The texture of the composition is referred to as “color,” and a trained eye can easily discern the quality of typography on the basis of its overall fit.
at the end of the line is equally divided between the beginning and end of the line, or they can be either flush left (quad left) or flush right (quad right), wherein all of the remaining space is placed either at the end or the beginning of the line, respectively (Figure 1.18).

The composition of justified lines of text has a long tradition in the graphic arts. Prior to the invention of printing, scribes laboriously copied manuscripts by hand. Because paper was very expensive, they paid special attention to filling each line with as many characters as possible. All of their lines were carefully written to be of consistent length, regardless of how words were broken (hyphenated). Early printers imitated this style in their effort to make the new craft of printing approach the quality of the established art of hand inscription.

**Figure 1.18**
Quadding variations commonly applied to paragraph composition.

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**Typography:**

**The Typographic Basics**

Four elements are common to every typeset job. These elements are descriptors, which specify how typeset text should appear on a page.

**Line Length**

Consider the typical typewritten document (Figure 1.19). If it became necessary to communicate a description of this page over the telephone so that the person you were talking to could duplicate the layout, what elements would you choose to describe? Assuming that a standard sheet of 8.5 × 11 inches will be used, it might be appropriate initially to specify the margins (their sizes and in the case of the right and left margins, whether they are flush on one or both sides). Subtracting the values of the left and the right margins yields the length of the line of characters if justified, and an approximation of line length if not justified. The first descriptor then is the “line length” or “line measure.”

**Character Size**

Measuring the number of characters per inch will determine the pitch—either pica or elite. This descriptor can be labeled “character size.”

**Typeface**

Thousands of typeface designs are in use today. For simplification, let’s say that the original page was composed on a typewriter (how quaint). Despite the smaller number of font choices on a typewriter, it might still be difficult, as it sometimes is in typesetting, to determine the exact identity of the type style that was used. Assuming that both you and the person on the other end of the telephone have a specimen sheet of common typewriter designs, you can then specify the “style.”

**Figure 1.19**
The anatomy of a generic typewritten page.
Interline Spacing
The remaining physical attribute is quite easy to evaluate. It is the vertical spacing increment, generally called “single or double spacing.”

Basic Parameters
If these four elements can be specified prior to producing a typewritten page, the appearance of the product will be very predictable. The same concept applies in typesetting, and similar descriptors, or parameters, must be specified.

Line Measure
Look now at the typeset job shown in Figure 1.20. From your experience with the previous typewritten example, you should have a good idea of what values you must derive before producing such a job. In the typeset example you must also have a line length or line measure. This parameter indicates how wide your typeset lines will be. It is specified in picas. If the line measure consists of any fractional part of a pica, as in 27 1/2 picas, the fraction is expressed in points, in this case 6 points (6 points = 1/2 pica). Some desktop publishing programs would express this line length as 27p6.

Type Size
The next parameter—although the order of specification is usually of no consequence when you are writing the specifications—is “type size.” Determining the size of previously typeset material is somewhat tricky because imagesetters (and page printers) can set in increments as small as 1/10 point (and even smaller), and because the sample being measured might have passed through a reproduction system (photo offset, photocopier, etc.) that could have altered the size of the characters. There is no way to determine how much change in type size might have occurred without a careful comparison between the printed sample and the original output from the imagesetter. For most work, a minute difference in type size is not significant; however, for some legal, business, and governmental jobs, as well as lengthy jobs in which a small increment will result in a significant difference, type size specification can be critical.

Measuring type size is usually performed with a clear type gauge or a magnifier with a special reticle. The purchase of a few measuring tools is a good investment for anyone involved in the specification of typographic information (Figure 1.21).

A good approximation of the size of the type is the measurement between the top of the ascender and the bottom of the descender (Figure 1.22).

Font
The next parameter to be determined is the typeface or type font. A font is the collection of all the letters, figures, punctuation, and special characters of a particular typeface design in a certain point size. In traditional terms, a
10-point Bodoni Italic and an 18-point Bodoni Italic are two different fonts. Today, most digital publishing applications refer to a typeface design as a “font,” without a size being associated with it.

Determining the type font is probably the most difficult task in this exercise. Remember, however, that we are working backwards in this example, trying to reconstruct a previously typeset job. This is not the usual approach. In most cases, the choice of typeface is selected from a specimen list, and this selection is based on criteria related to the purpose of the message or the function of the printed or presentation piece.

If you know the particular typesetting environment from which the example was set, then the universe of type-style choices is significantly reduced, and the problem becomes one of comparing the printed characters to a set of specimen sheets. However, if the environment is not known, you must depend upon your knowledge of typefaces and their subtle differences in design.

6. FontExpert Typeface Recognition Software is an expert system that does what even few typographic experts can do: accurately identify type specimens from printed samples. It does not require any measuring or interpretation on the part of the user, thereby eliminating the possibility of input errors or misinterpretation.

Digital publishers need to identify typefaces on a regular basis. A customer will present a sample of work that was done elsewhere and ask that a similar design be used. The challenge of finding either the exact match or a similar one may represent a significant time investment—one which cannot easily be billed to the customer. FontExpert can reduce the time to seconds, and produce an unrivaled list of matching fonts.

The program works from scanned images of a small number of characters. Although the scanned input is best at 300 dpi, the program still does a remarkably accurate job using fax-quality (200 dpi) character input. It compares the data that it extracts from the samples with its database of more than 20,000 fonts, each of which has data for all upper- and lowercase characters and the numerals. In seconds it presents a list, in order of physical similarity, of the typefaces that are the closest matches, along with a bitmap image of the character set that it has in its database. It is sufficiently accurate to be able to distinguish between character weights (light, regular, bold, etc.). It can also provide listings of “similar to” typefaces from competing font foundries.

FontExpert is available from Allied Compugraphics, Inc.; see Appendix A for contact information. A demo version of the software is available at the Allied Compugraphics Web site.

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Type and Typography

17

masters flat type, to emphasize the difference. Yet all type that appears on paper (or other substrates, or on a computer screen) is flat, regardless of its derivation, so what is needed is a definition of type as it appears to the reader and not the creator of the graphic images.

Does a typewriter create type? As mentioned earlier, some early designs of the typewriter actually used printers’ type on the typebars. Yet even today, after more than 100 years of typewriter development, it is easy to differentiate typewritten characters from typeset characters in most cases (Figure 1.25). To answer the above question, typewriters do not create type. For that matter, traditional

8/8 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

8/9 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

8/10 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

8/11 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

8/12 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

8/13 Packing: In computer programming, grouping two or more units of information into one unit to save storage space and reduce transmission time. The unit can later be "unpacked" and the original units reconstructed.

FIGURE 1.22
To find the point size of previously typeset material, locate an ascender and a descender in proximity with one another and measure the distance between their outer limits.

FIGURE 1.23
Line spacing is space added between lines of type, either to improve readability or to vertically justify lines to fill a page depth. Type size and line spacing are usually specified together, separated by a slash, as in “8/10.”

FIGURE 1.24
Johannes Gutenberg is considered the father of printing, having devised workable procedures for composing and reusing type and for mass-producing printed pages.
typesetting machines, such as strike-on devices, phototypesetters, and imagesetters, are only a segment of a growing population of devices with typesetting capability.

There are qualities associated with typeset characters that make them unique and immediately identifiable. A list of such attributes would include:

- Sharp, clean character edges
- Proportional spacing
- Range of point sizes
- Variations in character strokes (thick and thin)
- Variety of typeface designs
- Design variations of a single style (italic, bold, condensed, expanded, etc.)

The first two attributes are the most useful (and perhaps critical) in determining the quality level obtainable from a typesetting device. Often, evaluating them is based solely on subjective judgments. At graphic arts trade shows, the typeset output from competing devices is frequently compared under a magnifying glass, by experts and tradespeople alike. Usually, the result is that there is little agreement over which is best and why.

There are, then, a range of acceptable standards for typeset output. The particular level chosen is most likely based upon the purpose for which the type will be used (utilitarian, glamour, business); the environment in which it will be used (home, office, trade shop); the needs of the user (space factors, sizes, typefaces); the size and needs of the audience (short-lived information, archival storage, promotional, entertainment); and the methods of reproducing the message (copier, conventional printing, digital printing, digital transmission, on-screen).

Determining if a sample of characters can be classified as type is a fairly easy task when using the aforementioned attributes. What is difficult is evaluating how good the characters are as specimens of the typographic form. The answer to this question must be determined by the user, who considers all of the factors that are significant in a given situation. (Also see “What Distinguishes a Low-cost Font from a High-priced Font?” on page 99.)

Typeface Geometry

Type can be found almost everywhere we look: on store windows, buses, frozen food packages, tax forms, computer screens, and even medicines and candies. The proper use of type begins with some attention to the smallest parts of the letters, and some special terms used by typographers (Figure 1.26):

- The arm of a character is a horizontal projection or short, upward-sloping stroke.
- A bar is an enclosed horizontal stroke.
- The stem is the main part of the letter.
- A cross stroke or crossbar is that part of the letter which cuts across the stem.
- The tail or leg is a downward projection.
- The apex is the uppermost point at which the stems come together.
- The vertex is the lowermost joint at which the stems join.
- The ear is the projection found on certain lowercase g's.
- The spur is the finishing stroke on certain uppercase G's.
- The counter is the enclosed space within certain characters such as o, e, and a.
- The bowl is the rounded boundary found on letters such as p, q, d, and b.
- The loop is the closed round stroke found on certain lowercase g's.

When describing any of the thousands of typeface designs in use, typographers frequently speak of the characteristics of specific styles using these terms.
The collection of all of the various characters and symbols of a particular type design in a particular size is called the *font*. Fonts vary in size, from the basic alphabet to well over 200 characters (Figure 1.27). Unicode fonts (see page 111) may contain over 30,000 characters.

**Typographic Lines of Reference**

The relationship of characters to one another within a font is assessed most easily by viewing the characters in relation to the four typographic lines of reference. These lines are used by typeface designers to determine such things as the relative height of the lowercase characters to the uppercase characters (the *x-height*) and the amount of dip (below the baseline) that rounded lowercase characters such as *e* and *o* will require. In Figure 1.22, notice that all of the characters rest on the *baseline*. Directly above it is the upper limit of the main part of all lowercase characters, which is called the *mean line*. The distance between the baseline and the mean line is called the *x-height*, because it is the height of the lowercase *x*. Typefaces that have large (in relation to the point size) *x*-heights are usually easier to read (Figure 1.28).
## A Font of Type

<table>
<thead>
<tr>
<th>Uppercase</th>
<th>ABCDEFGHIJKLMNOPQRSTUVWXYZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Case</td>
<td>abcdefghijklmnopqrstuvwxyz</td>
</tr>
<tr>
<td>Small Capitals</td>
<td>ABCDEFGHIJKLMNOPQRSTUVWXYZ</td>
</tr>
<tr>
<td>Ligatures</td>
<td>Ɜ Ɡ Ɬ Ɪ ꞯ Ʞ Ʇ Ʝ et</td>
</tr>
<tr>
<td>Figures</td>
<td>1234567890 1234567890</td>
</tr>
<tr>
<td>Fractions</td>
<td>⅓ ¼ ⅔ ⅜ ⅝ ⅞ ⅓ ⅔ ⅞ ⅓ ⅔ ⅞ ⅓ ⅔ ⅞</td>
</tr>
<tr>
<td>Punctuation</td>
<td>, . / &lt;&gt; ; : ’ ” [ ] { } \</td>
</tr>
<tr>
<td>Commercial/Monetary</td>
<td>$ # % ¢</td>
</tr>
<tr>
<td>Superior Figures</td>
<td>A¹²³⁴⁵</td>
</tr>
<tr>
<td>Special Characters</td>
<td>© ™ • ®</td>
</tr>
<tr>
<td>Mathematical Signs</td>
<td>+ - ∞ ≈ ∫ μ ≤ ≥ + ≠ ∑ / ±</td>
</tr>
<tr>
<td>Swash</td>
<td>ABCDEFGHIJKLMNOPQRSTUVWXYZ</td>
</tr>
<tr>
<td>Reference Marks</td>
<td>$ ¶ † ‡</td>
</tr>
<tr>
<td>Ornaments</td>
<td>![Ornament Images]</td>
</tr>
</tbody>
</table>

*FIGURE 1.27*  
A standard font of type.
The two remaining lines are the extreme limits of the lowercase character shapes. Lowercase characters that descend below the baseline (g, j, p, q, y) are called descenders. The lowermost point of a descender is the descender line. Conversely, lowercase characters that ascend or project upward (b, d, f, h, k, l, t) are called ascenders. The uppermost point of an ascender is the ascender line, or as it is sometimes called, the cap line.

Single Typeface Variations

When type is being set, it is common practice to deal with different elements of a page layout in different ways. Although the same statement could be made about typewriting, there is considerably more flexibility in typesetting, even when limited typographic resources are being used. Headlines or other forms of composition that separate text should be set so that they stand out. Words in text that are to be emphasized also require special attention. It is possible to meet these needs by using variations of a single type design.

All-Capital Composition

Routine typesetting and typewriting involves the use of capital (uppercase) and lowercase letters. Two obvious variations are all-capital composition and all-lowercase composition. NOTICE THAT ALL-CAPITAL COMPOSITION CAN BE USED FOR EMPHASIS AND ALSO THAT IT IS MORE DIFFICULT TO READ.8 (There will be more to say about the readability of type later on.) All-lowercase composition is easier to read, yet robs the reader of important information that capital letters provide. Like all-capital composition, it should be used with discretion.

Italic and Boldface Variations

Traditionally, printers have used the italic and boldface forms to emphasize text and to organize information for easier reading. Most desktop computers have families of type available, which are standard variations of a basic typographic design. The traditional family usually includes an italic, boldface, lightface, condensed, and expanded version, although it might also include designs formed from a mix of these versions, such as a condensed lightface or an expanded boldface. Type family members all have physical attributes that make them design-compatible and therefore good choices for composing work involving multiple typefaces (Figure 1.29). In the realm of desktop publishing there is sometimes a distinction made between a simple and a complex family. A simple family consists of the basic members: regular, italic, bold, and bold italic, although it may consist of fewer members. A complex family is extended and includes most of the additional variations.

Desktop computers usually have the capability to produce a slanted variation of the normal character weight. This variation is an oblique (or pseudo-italic) that is slanted from 7 to 15 degrees to the right, although the system may identify it as italic. A true italic variation is one that is produced by the typeface designer, not one that is derived from another form. Type that is slanted beyond 15 degrees, either to the right or to the left, is said to be skewed (Figure 1.30).

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8. All-capital composition should also be avoided within e-mail messages, where it has become the functional equivalent of shouting.
Type Weight
In addition to the bold weight, the typeface design may have been drawn within a range of relative line thicknesses ranging from thin to black. The complete range of type weights is shown in Figure 1.31.

Typeface Family Management
There is a rich field of choices—for both character weights and widths—in PostScript Type 1 and TrueType fonts, and the native Macintosh and Windows operating systems support a variety of options. The operating systems can generate variations (bold, italic, bold italic, etc.) from the regular typeface, although it is inadvisable to do so. In addition, with third-party utilities, such as TypeTamer (Figure 1.32) or Adobe Type Reunion for Macintosh, the user can gather all family members within an application’s font menu in a hierarchical order.

Simulated Outline and Shadow Styles
True outline and shadow variations are drawn by the typeface designer; however, similar, although less compelling, effects can be simulated by word processing, desktop publishing, and other categories of programs on both Macintosh and Windows computers. Simulated variations often do not print well on high-resolution output devices, although they may suffice on laser and inkjet printers. In almost all cases, outline and shadow fonts should be used only in display sizes since they are inappropriate for body copy and their narrow opening and tinted shadows have a tendency to fill-in in small sizes.

Reverse Type
Text that must appear against a solid background, or be used in call-outs on a dark area of a photograph or illustration, is set in white. Reverse type (see Figure 2.65 on page 70) provides contrast with a black or dark background. White type set on a graphic or photograph is said to be dropped out. Reverse type can also be used to align type by repeating the line above, but setting the portion that is used as a spacer in reverse (Figure 1.33). This technique makes it possible to align bullets, or other listed items, without setting tabs.
Reverse characters are also used as fixed spaces. Designers may specify that they want to use the width of a lower case \( j \) between words in a headline. An actual \( j \) character, set in reverse, will produce a space equal to its width (Figure 1.34).

**Character Width**

Standard characters are designed in proportion to our expectations, neither condensed nor expanded (see “Anamorphic Reshaping,” page 39). Desktop publishing options usually provide controls over the relative width of the font, typically altering it in fixed 10% steps, but also allowing for single percent increments. The character width of type is usually altered to make a line of type fit precisely within a given line measure. Changing the width of a font should be done with care, however, since

![Figure 1.32](image1.png)

The TypeTamer utility provides the capability to list all installed fonts alphabetically and grouped by family. The user can see the actual font characters and select an individual character to insert directly in the text. (Impossible Software, Inc.; see Appendix A for contact information.)

![Figure 1.33](image2.png)

Reverse type can be used as a simple method for aligning text.

1. The first part of line one is repeated on each line...
   - Each Acme hardwood floor features: —A full 10-year warranty
   - Each Acme hardwood floor features: —Wet-mop clean-up
   - Each Acme hardwood floor features: —No-wax surface
   - Each Acme hardwood floor features: —Built-in scratch resistance

2. The unneeded text is highlighted and set in reverse...
   - Each Acme hardwood floor features: —A full 10-year warranty
   - Each Acme hardwood floor features: —Wet-mop clean-up
   - Each Acme hardwood floor features: —No-wax surface
   - Each Acme hardwood floor features: —Built-in scratch resistance

3. The reversed text provides precise spacing...
   - Each Acme hardwood floor features: —A full 10-year warranty
   - Each Acme hardwood floor features: —Wet-mop clean-up
   - Each Acme hardwood floor features: —No-wax surface
   - Each Acme hardwood floor features: —Built-in scratch resistance

![Figure 1.34](image3.png)

Any character can be used as a fixed space by composing it in the same color as the page background.

1. The headline is set using a \( j \) in place of each space.

2. Each \( j \) is set as a reverse character.

3. The result is word-spacing equal to the width of the \( j \) character.
extremes in either direction are unattractive and often look unnatural. Generally, it is better to modify the letter spacing value of a given block of text than to tinker with the set width of characters (Figure 1.35).

Small Caps
A less common single-face variation is the use of small capitals. Small capitals, or small caps, as they generally are known, are capital letters that have a lower cap line than the normal capital version of the same size. The small cap letters are, in fact, as high as the x-height of the lowercase characters. Because small caps have limited function, they were not usually part of the repertoire of characters available on a typesetting machine, although they are common within desktop publishing programs in a pseudo form. They can be composed from virtually any book typeface by setting them at approximately 80% of the cap height, and increasing the set width to 105–110%. The preferred method for setting small caps is to purchase the expert set of the font in question, which contains the properly designed characters.

Type-Size Variations
Varying type size is probably the most common method of producing variety in the appearance of typeset matter. The typesetting machines produced up to the early 1980s were manufactured with a built-in range of sizes that they were capable of reproducing. The ranges were in discrete steps, such as twelve sizes between 6-point and 72-point, or a continuous range, such as every half-point size between 5-point and 96-point. Regardless of the extent of the range, it usually embodied two categories of type size: text size and display size. Typically, the text range is considered to be sizes between 9-point and 12-point. These sizes are used for the body matter of books, newspapers, magazines, and the like. The display range includes all sizes larger than 14-point. These sizes are used for headlines and subheads in combination with body matter. A portion of a size range is shown in Figure 1.36.

Orientation or Rotation
After type has been composed, there are various orientations that can be applied to it. For example, it can be rotated, clockwise or counterclockwise, to any prescribed angle. Type may be set at an angle to conform with the orientation of a graphic element, such as a street name appearing on a map (Figure 1.37) or a photo that has been rotated for graphic effect (Figure 1.38). Text may also be rotated to set it apart from other elements on the page, in order to draw the reader’s interest. Additionally, text may be mirrored, to present a three-dimensional effect, or modified in some other way (Figure 1.39). (See “Special Effects Typography,” page 78.)
Chapter one
Type and Typography

A specimen of a point-size range for a single typeface. In general, the larger the point size, the more attention it gets from the reader. The selection of point sizes is normally based upon the relative importance of the information that is being displayed.

Identification of map features, such as roads, is much easier when the associated names are properly aligned.

Text is normally easiest to read when it conforms with the angle of the object that it identifies.

Courtesy of DeLorme Mapping, Lower Main St., POB 298, Freeport, ME 04032, 207 865-1234.
THE EXTENDED CHARACTER SET

A complete font of type includes much more than the characters in the alphabet, the figures, and the punctuation. Exactly which additional characters are included is based primarily on the Extended ASCII Directory, which defines the complement of characters that are considered to be standard, and those for which the font was designed. The variation in both the number of characters, and their identities, requires that the user be aware of the character mapping of his or her keyboard. The character map shows where each character in the font is located, and includes specification of the modifier key or keys necessary to access each character. A single key can produce up to four different characters, depending upon the modifiers used with it. For example, using the Palatino typeface, the M key can produce four variations on a Macintosh. A PC keyboard requires the use of the Alt key and a number sequence to generate two of these characters:

<table>
<thead>
<tr>
<th>Characters</th>
<th>Macintosh Key Combination</th>
<th>PC Key Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>Key alone</td>
<td>Key alone</td>
</tr>
<tr>
<td>M</td>
<td>Key + shift</td>
<td>Key + shift</td>
</tr>
<tr>
<td>µ</td>
<td>Key + option</td>
<td>Alt + 0181</td>
</tr>
<tr>
<td>Â</td>
<td>Key + shift + option</td>
<td>Alt + 0194</td>
</tr>
</tbody>
</table>

Specialized fonts—such as symbols, dingbats, icons, logos, ornaments, and other non-alphabet designs, as well as foreign language, scientific, mathematical, musical, and other special-purpose fonts—depend upon a software aid or printed keyboard layout for locating characters. The Macintosh has a desk accessory called Key Caps that provides a visual display of the keyboard based on the modifier key(s) that are in use (Figure 1.40).

The extended characters that are available on a Windows computer can be viewed by using the Character Map accessory. It shows the Alt-key combinations (pressing Alt+0+character number) which are necessary to pro-
duce characters that do not have either a dedicated key or a common key sequence (Figure 1.41).

The Macintosh and Windows operating systems do not map all character positions uniformly, so files that are shared between the two systems may show anomalies. Care should always be taken when transferring files that contain members of the extended character set. The use of Unicode fonts (see page 111) will not only overcome this problem, but will provide a universal solution for correctly specifying and displaying virtually any character shape.

**Typeface Classification**

One of the most perplexing problems confronting someone new to typesetting is the overwhelming variety of typeface designs from which to choose. There are literally tens of thousands of styles available, many of which have families drawn as well. Printers have devised many methods for classifying typefaces on the basis of either the physical attributes of the designs or their historical development. The complexities of organizing such a vast population of designs, coupled with the subtle design differences of similar typefaces, make identification of particular typefaces difficult, even, in some cases, for experienced typographers. For this reason, only a basic scheme of typeface classification will be offered here (Figure 1.42).

**Serif versus Sans Serif**

A typeface either has, or does not have, serifs. Serifs are ending strokes on the arms, stems, and tails of some typeface designs. If a typeface has serifs, it is termed a roman typeface. If the typeface is without serifs, it is called a sans serif typeface. Typefaces that slant to the right, be they serif or sans serif, are called italic variations. Almost all type families include an italic member, and usually a bold-face member as well (Figure 1.43).
Roman
The designation of serifed typefaces as roman is complicated by the fact that any typeface which stands upright in comparison to an italic form is also called roman. This system of designation is somewhat confusing since both roman and sans serif typefaces have italic forms.

Blackletter
The earliest typefaces—those from the Gutenberg workshop—were copies of the letterforms found in handwritten manuscripts. As a group they are called Blackletter, a version of which is referred to as Old English. These letters appear heavy and ornate, and have angular serifs.

Old Style
Printing from movable type spread from Germany southward to Italy, and there the classical letterforms of Humanist manuscripts became the model for the roman typefaces. The earliest roman forms were called old style.

Modern
The roman forms underwent many changes during the period from approximately 1470 to 1775. In 1775, Giambattista Bodoni introduced a type design of mechanical structure, with heavy stems and light serifs. His design is classified as a modern typeface.9

Square Serifs
Around the turn of the nineteenth century, a new commercial interest in type design began. One significant result of that attention was the formation of a group of type designs called the square serifs. Square serifs have squared-off serifs at the extremities of each character.

Sans Serif
In 1816, William Caslon IV designed a typeface with no serifs. This design was in itself an innovation of major proportions. It was the first sans serif typeface, the first of many and the beginning of a major classification. Sans serif typefaces usually require more line spacing since their simpler design does not provide readers with the advantage of horizontal serifs to lead their eyes across the page.

Scripts and Cursives
Typefaces that imitate handwriting were first used in the sixteenth century. They appear to be drawn with pen and ink, and are classified as scripts and cursive. The letters of a script typeface are joined; the letters of a cursive typeface are not.

Decorative and Display
Typefaces that do not fit into any of the previous classifications can be grouped into a category called decorative and display.

Typeface Recognition
The recognition of a particular face is usually accomplished by identifying a distinctive character, often a g or an a; or by noting certain design characteristics, such as the finishing stroke on Q, or the spur on the G (Figure 1.44).

Making Type Easier to Read
Two measures are used to assess how easily a typeface can be comprehended by a reader. The first is the legibility of the typeface, i.e., how well each character design

conveys its symbolic form to the reader. It is obvious that the various letter \( R \)'s in Figure 1.45 are not all equally identifiable as that character. The degree of legibility that a typeface possesses is controlled by the typeface designer. Although the legibility is designed into the typeface, and its features cannot be changed by the user, the manner in which the typeface is used can directly affect how easy the type is to read. The use of type in its position in a layout, in its relation to other graphic elements, and in its specific form (type size, line length, line spacing) on the page are all aspects of \textit{readability}—the second measure of typeface comprehension—and are all under the control of the page designer.

The Legibility of Print

Within typographic circles, the question has arisen of how it is possible, within a printed piece, to divorce the legibility of the typeface from the readability of the printed or displayed material. The consensus is that, realistically, it cannot be done. The legibility of a typeface—roman or sans serif, italic or bold—is just as much a factor in readability as are line length, line spacing, and point size. In other words, too long a line length, little or no line spacing, and the wrong choice of point size can ruin the legibility of a typeface by altering the criteria under which it was designed. Conversely, an illegible, poorly designed, or extremely ornate or complex typeface cannot easily be improved by the variables of readability. Since legibility and readability are so intimately related in their influence on the effectiveness of graphic communication, the term \textit{legibility of print} has been devised to refer to both.

The Measurement of Work

Numerous studies have been conducted to determine the typographic factors that are most significant in increasing the legibility of print. Although most of these have been conducted in relation to print media, the results can be applied, with caution and judgment, to text displayed in electronic media formats. Most of the print research has used the \textit{measurement of work} as the method of assessment. Since 1896, this measurement has been defined as the speed, in time, at which subjects are able to read and to locate answers to problems.

\textit{Reading} has been defined by Smith and Decant as “the perception of graphic symbols. It is the process of relating graphic symbols to the reader’s fund of experience.”\textsuperscript{10} This definition is valid regardless of whether the reader is viewing a printed page or a computer monitor. Reading has, therefore, three main variables: the graphic symbols, the form of presentation (printed material, screen display, etc.), and the reader.

To the mix of variables associated with the legibility of print we can add those that the reader touches, such as the tactile feel of the paper surface, and those that the printer has chosen and the reader sees, such as the color of the paper and ink, and the overall color or contrast of the page. In an electronic media environment, the legibility of print can be influenced by the size, brightness, and glare of the screen, as well as the background and foreground colors used on the screen display.

The reader presents his or her own mix of variables: his or her personality, age, sex, IQ, maturity, willingness to learn, frustration tolerance, and reading skills, including eyesight. Other factors are the textual intent, whether pleasure-oriented or work-oriented, the length of text matter, the degree of interest, and the rate of speed and fatigue.

There is one other fundamental difference between reading print and reading from a Web site. The print material, in a physical form such as a book, can be evaluated quickly in terms of its length and content. The reader forms

\begin{itemize}
  \item Bell Bold
  \item Bodoni Bold
  \item Centaur Bold
  \item Cooper Black
  \item Helvetica Bold
  \item Myriad Bold
  \item Palatino Bold
  \item Times New Roman Bold
\end{itemize}

\begin{itemize}
  \item Asphalt-Black
  \item Avalon
  \item Caflisch Script
  \item Carnival
  \item Civilite
  \item Critter
  \item Lilith Initials
  \item Old English Text
\end{itemize}

\begin{itemize}
  \item FIGURE 1.44
  Certain characters, such as the lower case \( g \), have definite, defining characteristics that provide clues as to the identity of the typeface.

  \item FIGURE 1.45
  Eight examples of the letter \( R \). How would you rank them in terms of their legibility?
\end{itemize}

an opinion (and perhaps an attitude) related to how long it will take to read, how much effort it will require, and how enjoyable the experience may be. The reader who is presented with a Web site can make no such assessment. The amount of material at the site is impossible to determine. You can’t judge a Web site by its home page, any more than you can judge a book by its cover. Additionally, the book can be read anywhere; at a desk, in a lounge chair, under a tree—Web pages, generally, must be read while sitting in front of a computer. 

Finally, printed text retains its physical location on the page, which sometimes acts as a memory cue in the retention process. Scrolling displays of Web text generally do not offer such physical landmarks.

Eye Movements
As early as 1907, Ruediger, a reading researcher, concluded that the eyes can easily process ten times the number of words that they actually do. The main impediments to speed, he found, were the comprehension and the quality of the text. He found that fluency of comprehension was directly related to smooth, rhythmical eye movements. The eye tends to divide a line of text into even units, and fixates upon these delineations in even jumps. This phenomenon is called point vision. E. W. Dolch has concluded that “the good reader is not fixating words or phrases of sentences. He is actually and literally fixating parts of the line.”

These facts have had a direct and quite meaningful impact on the use of type. Since the fewer fixations the eye must make causes greater speed of reading, it makes sense to use a minimum of space between words (word spaces) and to avoid wide or extended typefaces, which are now known to reduce reading speed and to cause eye fatigue.

Block Outlines
In 1910, Bertram Goodhue, the designer of the typeface Cheltenham, wrote that reading speed is dependent upon a reader’s ability to make “pictures” out of words. Almost 25 years earlier, Cattell had shown by experimentation that the eye is capable of perceiving a whole word as quickly as a single letter. The block outlines of lowercase words provide a distinctive form, one not to be found in all-capital composition (Figure 1.46).

SPECIAL SHAPES

Special Shapes

Character Differentiation
The composition of all capitals has been proven to decrease the legibility of print. In extensive studies, G. W. Ovink found that differentiating characteristics of capitals must be clearly discernible. For example, the cross stroke at the bottom of the Q, which differentiates it from the O, must be obvious. He also found that the middle arm of the E and F should be shorter than the top arm and should not be too narrow, and that hairline stems and serifs and heavy or long serifs should be avoided.

Character Shapes
Lowercase letters having more variation in shape have a greater legibility in print. Investigations by Ovink, Roethlein, Sanford, and Tinker all reached this same conclusion. Among their findings was that the relative width of the lowercase letter is a factor in legibility. Compare how easily an e or an i is read as opposed to an m or a w. They also found that the more simple the outline of the letter, the more legible the letter; that the serifs affect legibility; that shading, or variation of stress, affects legibility; and that the white space, or spaces within the outline of a letter, is a strong influence on that letter’s legibility—the greater the space, the greater the legibility.

Much research has been conducted into the mechanical aspects of type design. Some of the earliest interest was expressed by Benjamin Franklin in a letter to Noah Webster concerning type contour, in which he wrote “[it] makes the line more even, but renders it less immediately legible; as the paring of all men’s noses might smooth and level their faces, but would render their physiognomies

12. According to Miles A. Tinker, Schwarz in 1775 was the first to notice that the lower case is more legible than the upper case.
14. Ibid.
In the early 1880s, Javal suggested the reconstruction of letter forms and the shortening of descenders. He based his recommendations on his observations from first covering the top half of a line of text, then the bottom. He concluded that it was much easier to read the top half with the bottom half covered than vice versa (Figure 1.47). The eye does seem to define word forms in terms of their upper structural components.

In addition to the consideration of legibility of print, digital media designers, especially, must be concerned with the legibility of color. The ready availability, at no cost, of on-screen color requires some degree of attention to the choice of colors to be used in any particular job. Research suggests that the best color combinations for displaying text is black type against a white or yellow background.

**Type Size**

The size of the text type that is used does not seem to have a significant effect on the legibility of print. Studies by Paterson and Tinker, as well as by Luckiesh and Moss, have found that sizes between 9 and 12 points do not differ appreciably in this regard. Among older readers, however, larger sizes are preferred for obvious reasons.

**Type Weight**

Surprisingly, the weight of a typeface—that is, its degree of boldness—does not have much effect on reading speed (Figure 1.48). A study by Paterson and Tinker revealed, however, that 70% of those taking part in the investigation (320 subjects) had a definite preference for the normal weight of type as opposed to the bold.

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improve legibility significantly. As a general rule, indentation can begin the opening of a series of paragraphs. Studies conducted in the 1960s by Miles Tinker found that indentation can significantly affect the legibility of print. Even subtleties in text arrangement, such as paragraph indentation, can significantly affect the legibility of print. An indentation is a space that sets the paragraph apart from other lines of type. It helps the reader’s eye to identify and organize blocks of text. Only the first paragraph of a chapter or major subdivision does not require the indentation, since the reader has no difficulty determining the beginning of a series of paragraphs. Studies conducted in the 1960s by Miles Tinker found that indentation can improve legibility significantly. As a general rule, paragraphs with line lengths up to 18 picas should be indented 1 em space; those with line lengths from 19 to 23 picas should be indented 1½ em spaces; and those with line lengths between 24 and 30 picas should be indented 2 em spaces. Editorial style, or design designation, however, might dictate otherwise.

Quadding

The last line of a paragraph does not usually fill the line measure. In hand composition, large metal spaces two or three times as large as an em were used to fill the space to the right of the final line. These spaces were called quads, and the process of using them was called quadding. In typeset output from a phototypesetter or imagesetter, space is simply the absence of an exposure of light to photographic material. Quadding becomes a machine command controlling the position of less than a full line of type. The last line of a paragraph is pushed to the left, and therefore is called quad left (QL or flush left). A line pushed to the right is designated as quad right (QR or flush right). Centered lines are designated as quad center (QC or centered).

When lines are quadded, they gain the benefit of uniform word spacing. Because all excess space in a line is placed to the left, the right, or divided between the two, the fit of words in quadded lines is usually easier to read. Many publications have adopted the practice of setting all lines quad left, in a style known as ragged right or flush left, ragged right. This style of line orientation has been shown to be easier to read. It also helps to avoid what George Bernard Shaw described as “rivers of white [which] trickle down between words like raindrops on the window pane.”

Most readers are not aware of whether the text they are reading is ragged or justified. Do you know which style your daily newspaper uses? Check it the next time you pick up a copy.

Line Spacing

The vertical space from the baseline of one line of type to the baseline of the following line of type is called line spacing or leading. The term leading is derived from the practice of setting type by hand and separating each line of metal type with a thin 2-point strip of metal called a lead (Figure 1.50).

A block of type is specced, or marked-up, by indicating the size of the type followed by the line spacing. If the type is 10-point, and the line spacing is 12-point, then the markup would be “10/12,” which is read “ten on twelve.” As a rule of thumb, line spacing is usually 120% of the point size (Figure 1.51).

Letterspacing

Sometimes the justification of lines of text is attempted under the worst of conditions. The line measure might be too short, or the words might be too long and unhyphenated, the minimum word space might be too wide, or the text might be wrapped around an irregular graphic. The result is copy that is poorly spaced and difficult to read (Figure 1.52).

Words can be spaced only so far apart before they lose their cohesiveness and become difficult to read. For this reason, most professional typesetting software has typographic spacing controls, which allow the user to set minimum and maximum expansion limits for word spaces.

When the maximum word-space value is surpassed, and if the user has specified the option, small increments of space are added between individual characters in the line. This letterspacing degrades the word shapes on which the reader’s eyes depend for quick recognition (Figure 1.53). Letterspacing should be avoided if possible.

A certain amount of letterspace is designed into each character, so that it does not touch the character that precedes or follows it. This minute space, located on both the left and right sides of each character, is called the left and right side bearing. The side bearings establish the inter-character space that the designer has determined to be optimum. Designers typically increase the side-bearing spacing for typefaces that will be viewed on-screen.

**Kerning**
The opposite of letterspacing is kerning. Instead of adding space between letters to fill a line, minute increments of space are subtracted from between certain character pairs in order to improve their fit and therefore make them more eye-appealing. Kerning is most common in display advertising, where differences in character fit are most obvious and aesthetically unacceptable (Figure 1.54).

The typographic implications of this capability are enormous. Not only can customers’ input be received over the telephone (immediately, and from any distance), but, by using a dedicated computer which offers electronic mail, customers may leave files for pick-up at the convenience of the typesetter operator (usually at night when the telephone rates are lowest). Completed typesetting can then be mailed back to the customer. Even with the speed of the Postal Service, this method of doing business can be more efficient than current practices.

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Tracking
Some typesetting systems and page-layout programs have an additional character-spacing option, usually referred to as character compensation or tracking. This option permits the user to specify a small increment of space that is to be uniformly removed—or less commonly, added—between all characters. The result of using negative tracking (reducing intercharacter space) is tighter-fitting—although not necessarily more readable or more eye-pleasing—typography. Negative character compensation can be used effectively to save space by squeezing characters closer together. The addition of space between characters can be used to lighten the “color,” or overall pattern of density (the balance of black and white), that a particular font creates on a page or screen (Figure 1.55).

Hyphenation
The hyphenation process is linked intimately with the process of justification. The objective of line justification, as we have already discussed, is to pack as many characters on one line as will reasonably fit, while maintaining optimum word spacing and avoiding letterspacing. Hyphenation becomes necessary when a word falling at the end of a line causes that line to exceed the point at which it should be ended (the justification range).

Early phototypesetting machines required the use of perforated tapes with all end-of-line information included; in other words, the lines had to be justified prior to typesetting. These justified tapes could be prepared on a counting keyboard, which calculated the unit width of each typed character and indicated to the operator when the justification zone was reached. Another method involved running an unjustified tape through a reader on a special computer so that a new justified tape could be prepared.

The first use of a digital computer in the typesetting field occurred during the early 1960s, when a general-purpose computer, used for accounting and payroll functions, was programmed for typesetting. Removing the end-of-line, decision-making function from the perforator operator resulted in two major benefits. It increased the through-put speed and also allowed the operator to produce a tape from a less-sophisticated and less-expensive keyboard.

One of the first computers built to perform a specific (special-purpose) typesetting task was the Compugraphic Linasec. It was used to justify tape, but lacked the storage capacity necessary for hyphenation, thereby requiring a human monitor to respond to word breaks appearing on a CRT screen. The Linasec was followed by the Compugraphic Justape, which had the ability to accept an unjustified tape and output a justified tape, all without the aid of a human monitor.

Today, typesetting machines (imagesetters, plain-paper typesetters, page printers, etc.) receive rasterized page information which is derived from data that has been composed in the computer, where all of the hyphenation and justification (popularly known as H & J) calculations have occurred.

\[\text{FIGURE 1.55}\]
Tracking serves to change the space between characters uniformly, without consideration for individual character shapes.

No Tracking
No well conducted printing-office can be carried on without rules, yet it is generally a mistake to formulate a vast number of regulations and post them up in different parts of the establishment. Some of those which are to be found in particular offices are unnecessary, for an acquaintance with them is presupposed when a workman is engaged, as he must have served an apprenticeship. It is unnecessary, for instance, to establish a rule that men must pick up the type they drop. (American Dictionary of Printing and Bookmaking, 1894)

Loose Tracking
No well conducted printing-office can be carried on without rules, yet it is generally a mistake to formulate a vast number of regulations and post them up in different parts of the establishment. Some of those which are to be found in particular offices are unnecessary, for an acquaintance with them is presupposed when a workman is engaged, as he must have served an apprenticeship. It is unnecessary, for instance, to establish a rule that men must pick up the type they drop. (American Dictionary of Printing and Bookmaking, 1894)

Tight Tracking
No well conducted printing-office can be carried on without rules, yet it is generally a mistake to formulate a vast number of regulations and post them up in different parts of the establishment. Some of those which are to be found in particular offices are unnecessary, for an acquaintance with them is presupposed when a workman is engaged, as he must have served an apprenticeship. It is unnecessary, for instance, to establish a rule that men must pick up the type they drop. (American Dictionary of Printing and Bookmaking, 1894)
The H & J algorithms used in most desktop publishing, design, and screen-presentation applications use a line-at-a-time method to determine end-of-line decisions. This is less elegant than other methods, such as those used by the TeX typesetting language, which applies a set of expert rules to the entire paragraph in order to determine the optimum line-break points.

Hyphenless Justification
When the last word in a line exceeds the line measure, one option is to carry the entire word over to the next line and make up the space by using interword and intraword spacing. If all such hyphenation decisions are made in this manner, the result is hyphenless justification, which gives the appearance of very loose lines. Hyphenless justification is a poor typographic style and should be avoided.

The alternative is to hyphenate the word and carry only part of it to the next line. Most traditional typesetting machines accomplished this process by using one or a combination of three different methods: discretionary hyphenation, the rules of English, or dictionary look-up.

Discretionary Hyphenation
The first method of hyphenation relied totally on the judgment of the keyboard operator. The operator might anticipate that the typesetter’s computer logic could not differentiate between certain words, such as pre-sent and pres-ent, or be able to handle the hyphenation of certain technical terms or unusual names. In such cases, the operator would insert a code called a discretionary hyphen (or soft hyphen) at the proper points, to make the correct break points obvious to the computer, should that particular word exceed the justification zone. If such words did not fall at the end of the line, the discretionary hyphenation codes were ignored during processing.

The Rules of English
The second hyphenation method relied on the rules of English language logic. The typesetter computer was programmed with information based upon grammatical usage. Such instructions included not breaking a word (a) after fewer than two letters, (b) so that three or fewer letters were carried to the next line, (c) after a consonant followed by a vowel, and (d) before a punctuation mark, as well as many others. Logic programs were not perfect because there are many exceptions to accepted rules of English usage. At best, such programs were about 98% accurate.

Dictionary Look-up
The third and most precise method of hyphenation was by dictionary look-up. In this method, an entire dictionary was stored on hard disk and consulted as needed. Although this method was very effective, it was also more expensive and required continuous updating for new words. A variation of this method was an exception-word dictionary, a special collection of words that a particular user or company frequently encountered. The exception-word dictionary was used in conjunction with a logic program and with discretionary hyphenation, as well as in cases of confusing word pairs.

28. A notable exception is the Adobe Multi-Line Composer introduced in the InDesign program in 1999.
29. TeX is a sophisticated program that facilitates the setting of complex typographic matter, most notably of a mathematical nature. It was written by Donald Knuth of Stanford University. TeX uses what Knuth refers to as “control sequences” to communicate the form in which a specified portion of text is to be processed. There are about 900 control sequences that TeX is capable of processing, and the user retains the option of respecifying commands so that he or she can remember them more easily.